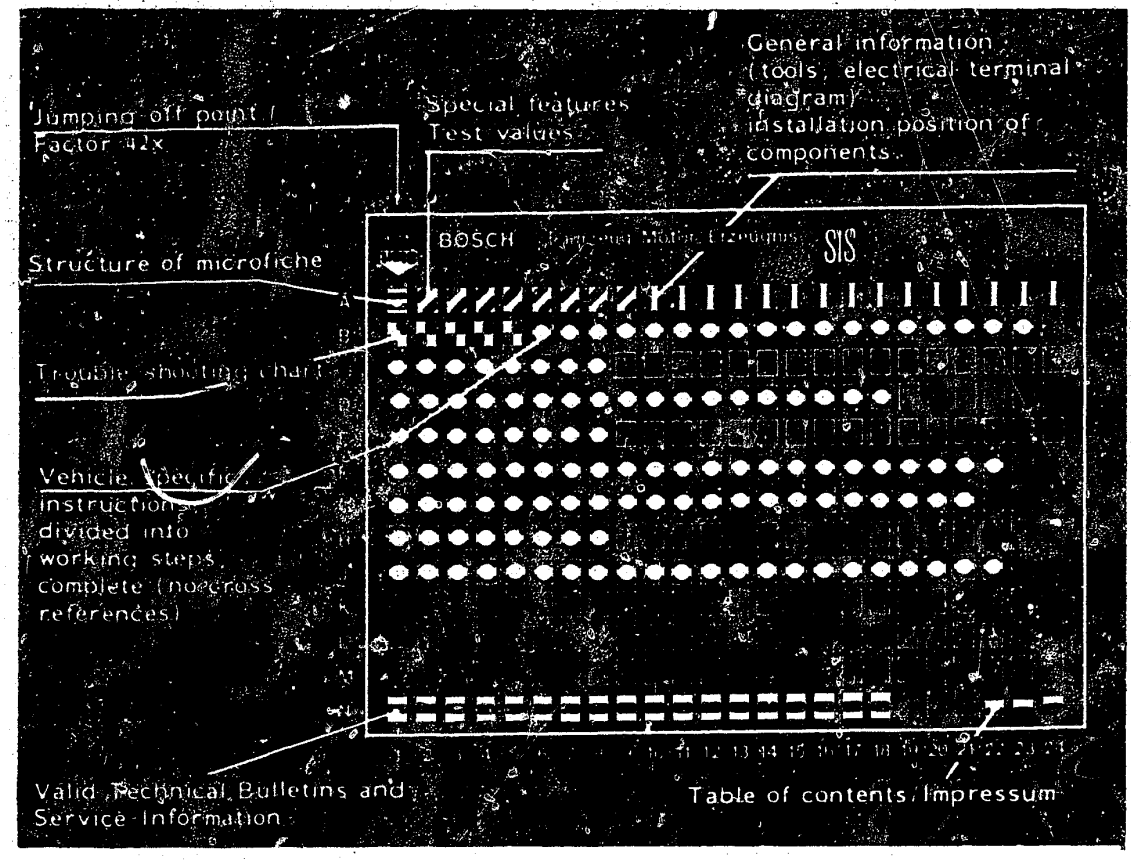
Microfiche layout



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/assembly/test step Vehicle/engine	

Coordinate

3. Limits of section

Beginning	Mid-section	End	One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

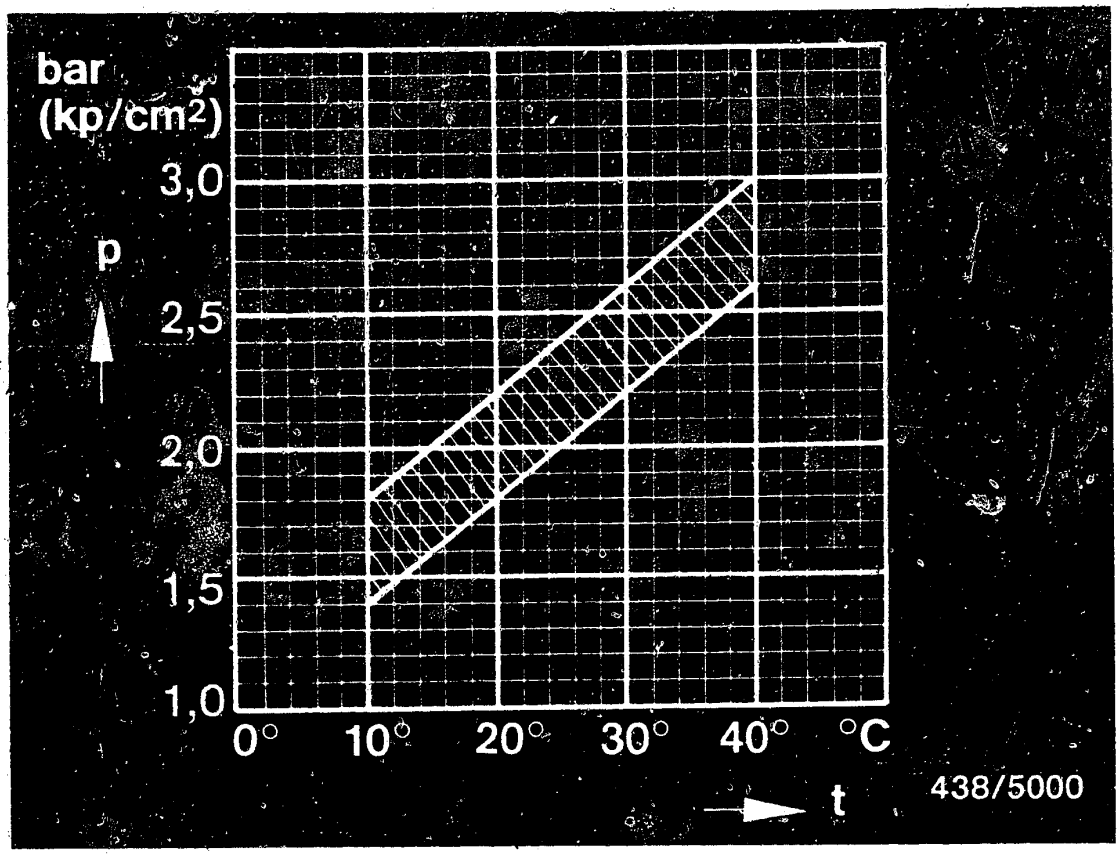
1. SPECIAL FEATURES

- Fuel distributor with adjustable differential-pressure valves.
- Warm-up regulator with altitude compensation.
- Air-shrouded injection valves.
  Air distribution in cylinder head.
  As of 1984 model, injection valves with fixed air-guide cap for air shrouding.
- In-tank electric fuel pump with screwed-on pressure damper for noise reduction.
- Idle valve 1 for engine-speed increase when idle speed drops below approx. 700 min^{-1}
- Idle valve 2 for engine-speed increase when air conditioner on.
- 35-pin control unit for lambda closed-loop control. Partly externally encoded in plug.
- Thermo-switch in coolant line for mixture enrichment when engine temperature below + 25°C.
- Miles counter and an "OXS" warning lamp in instrument panel.
- Catalytic converter.

2. TEST SPECIFICATIONS

Test step	Test specifications*
2.1 Electric fuel pump	**C1**
• Fuel delivery:	min. 750 cm^3/30 s
• Terminal voltage:	min. 11.5 V under load
2.2 Fuel distributor	**E1**
• Primary pressure	
Fuel distributor:	
0 438 100 116 Checking value	4.7...5.4 bar (4.8...5.5kp/cm^2)
Setting value	4.9...5.1 bar (5.0...5.2 kp/cm^2)

* Pressures in the test-specification table are given in bar (gauge pressure) and in kp/cm^2 (gauge pressure).



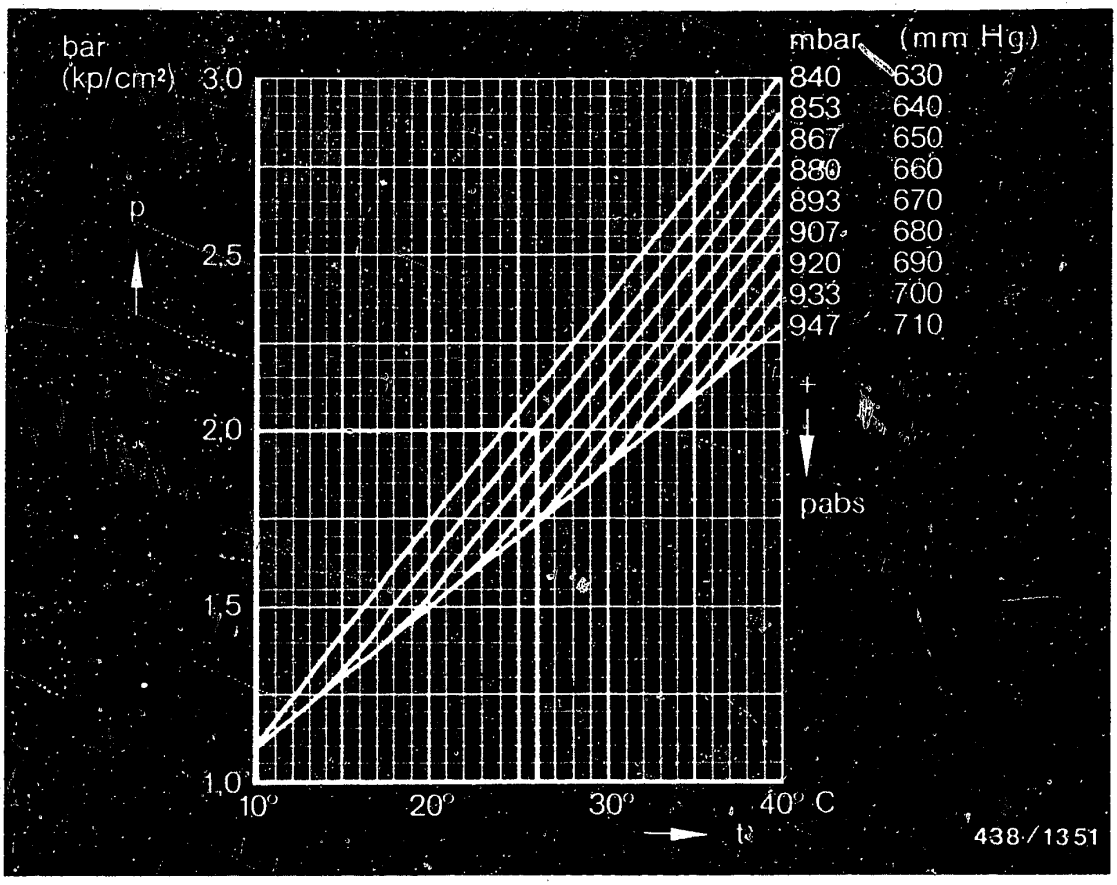
p = Control pressure (gauge pressure)
t = Ambient temperature

D1

2.3 Control pressure "cold"

- Warm-up regulator part number: 0 438 140 011

  Basic version of warm-up regulator



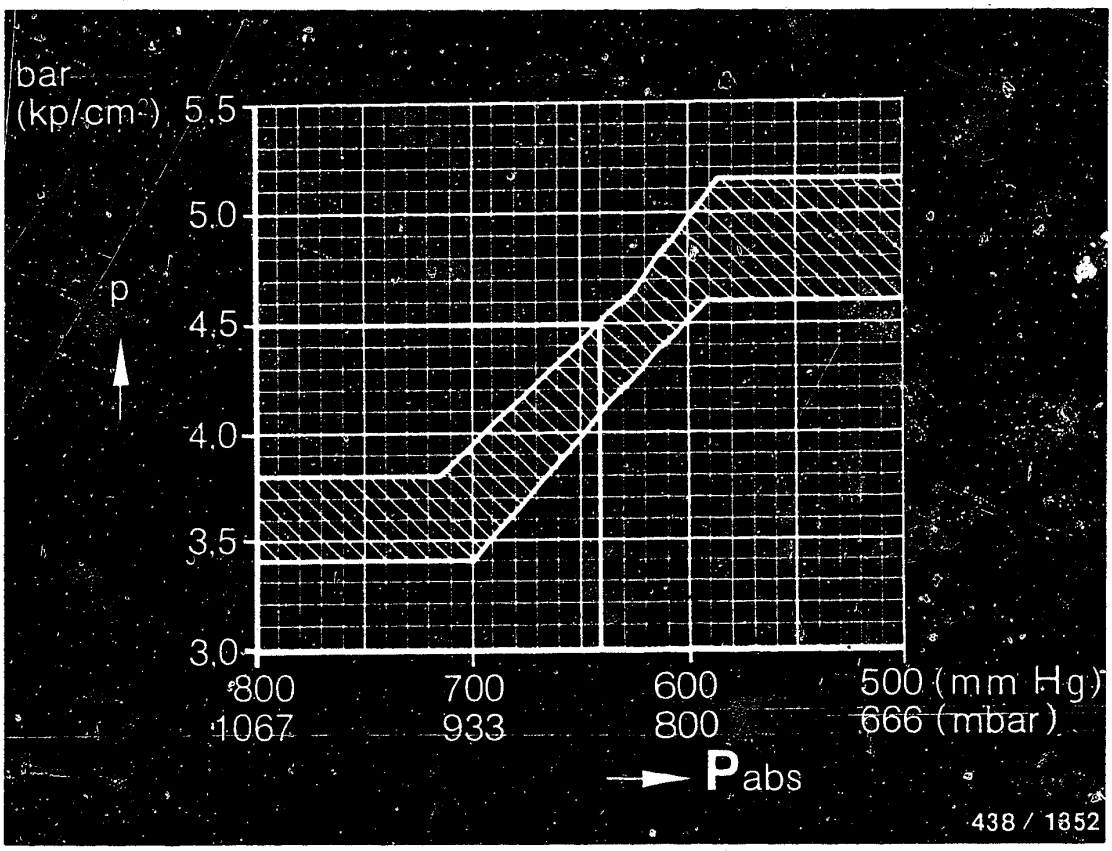
p = Control pressure (gauge pressure)
t = Ambient temperature
pabs = Air pressure

D1

- Warm-up regulator part number 0 438 140 026/.. 027
  Version for altitude compensation

- "Cold" control pressure

Obtain the specified value for control pressure from the diagram to correspond to the ambient temperature and the atmospheric pressure.
The basic curve for the control pressure is subject to a tolerance of ± 0.2 bar.
The altitude curves for the control pressure are subject to a tolerance of ± 0.25 bar.
The basic curve applies for atmospheric pressure greater than 947 mbar (710 mmHg).



p = Control pressure (gauge pressure)
pabs = Air pressure

D1

2.4 "Warm" control pressure

Warm-up regulator 0 438 140 026/... 027
(model with altitude compensation)

Measure the control pressure immediately after the warm-up regulator cuts out.

Test step	Test specifications*	
Control pressure "warm"		**D1**
• Warm-up regulator 0 438 140 011 Basic version	3.4...3.8 bar (3.5...3.9kp/cm²)	

2.5 Leak test **F1**

	for fuel accumulator Part No.: 0 438 170 027 0 438 170 028		0 438 170 040 0 438 170 041
	up to FD 931 (identified by blue dot)	as of FD 932	
Min. pressure after 10 minutes:	2.2 bar (2.3kp/cm²)	2.5 bar (2.6kp/cm²)	2.5 bar (2.6kp/cm²)
after 20 minutes:	2.0 bar (2.1kp/cm²)	2.4 bar (2.5kp/cm²)	2.4 bar (2.5kp/cm²)

2.6 Injection valve	0 437 502 023/..024 0 437 502 026/..027	**G1**
• Opening pressure	3.0...4.1 bar (3.1...4.2 kp/cm²)	
• Leak test: not below 2.8 bar:	No drop may fall within 25 s.	

* Pressures in the test-specification table are given in bar (gauge pressure) and in kp/cm² (gauge pressure).

Test step	Test specifications

2.7 Fuel distributor 0 438 100 116

G10

- Comparative measurement of fuel deliveries:

	Setting point	Max. allowable delivery
Idle	6.0 cm^3/min.	6.6 cm^3/min.
Part load	40.0 cm^3/min.	43.0 cm^3/min.
Full load	122.0 cm^3/min.	134.0 cm^3/min.
This full-load delivery must be obtained at least with maximum deflection of air-flow sensor plate.		

2.8 Thermo-time switch 0 280 130 214 / 0 280 130 223

C5

- Resistance measurement between

at temperature below °C	above °C	term. "G" and "ground" (housing)	term."W" and "ground" (housing)	term."G" and term. "W"
+ 30		25...40 Ω	0 Ω	25...40 Ω
	+ 40	50...80 Ω	100...160 Ω	50...80 Ω

2.9 Idle adjustment*

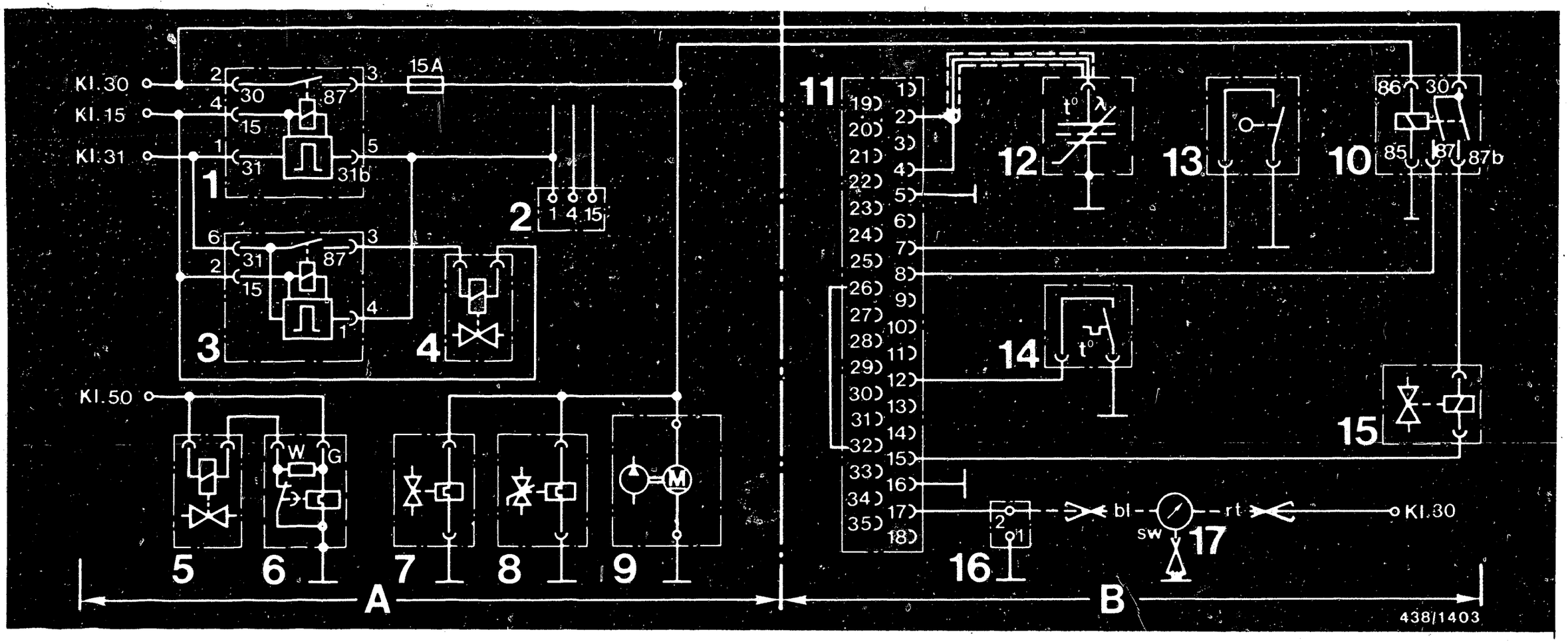
H1

- Idle speed
  All versions: 850...1000 min^{-1}
- CO concentration: 0.3...1.2 vol. %
- with on/off ratio fluctuating
  checking value: 25 ... 65 %
  setting value: 50 %

* For adjusting/checking the idle: Switch on upper beam, switch off air conditioner. Engine at normal operating temperature, oil temperature approx. + 80°C. Radiator fan must not operate when adjusting. Disconnect crankcase ventilation hose from cylinder-head cover and seal end of hose.

Test step	Test specifications
2.10 Lambda closed-loop control*	**J1**
• On/off ratios:	
t_0 (lean stop)	max. 20%
t_1 (open-loop control)	45 ... 55%
t_2 (rich stop)	min. 87%
t_3 (warm-up enrichment)	75 ... 85%
t_4 (full-load enrichment)	60 ... 70%
Closed-loop control fluctuating between	25 ... 65%
Timing valve	
• Electrical internal resistance at +20°C:	2.0 ... 3.0 Ω
Thermo-switch	
• Switching temperature	
closed	below + 20°C
open	above + 30°C

* Functional test and adjustment of lambda closed-loop control:
Warm up engine with lambda sensor connected. Then disconnect sensor lead;
adjust CO concentration.
Re-connect sensor lead. CO concentration must now drop to max. 1.0 %. Checking the on/off ratios: Between t_2 and t_3 a clear difference in reading must be recognizable.



A = Safety circuit

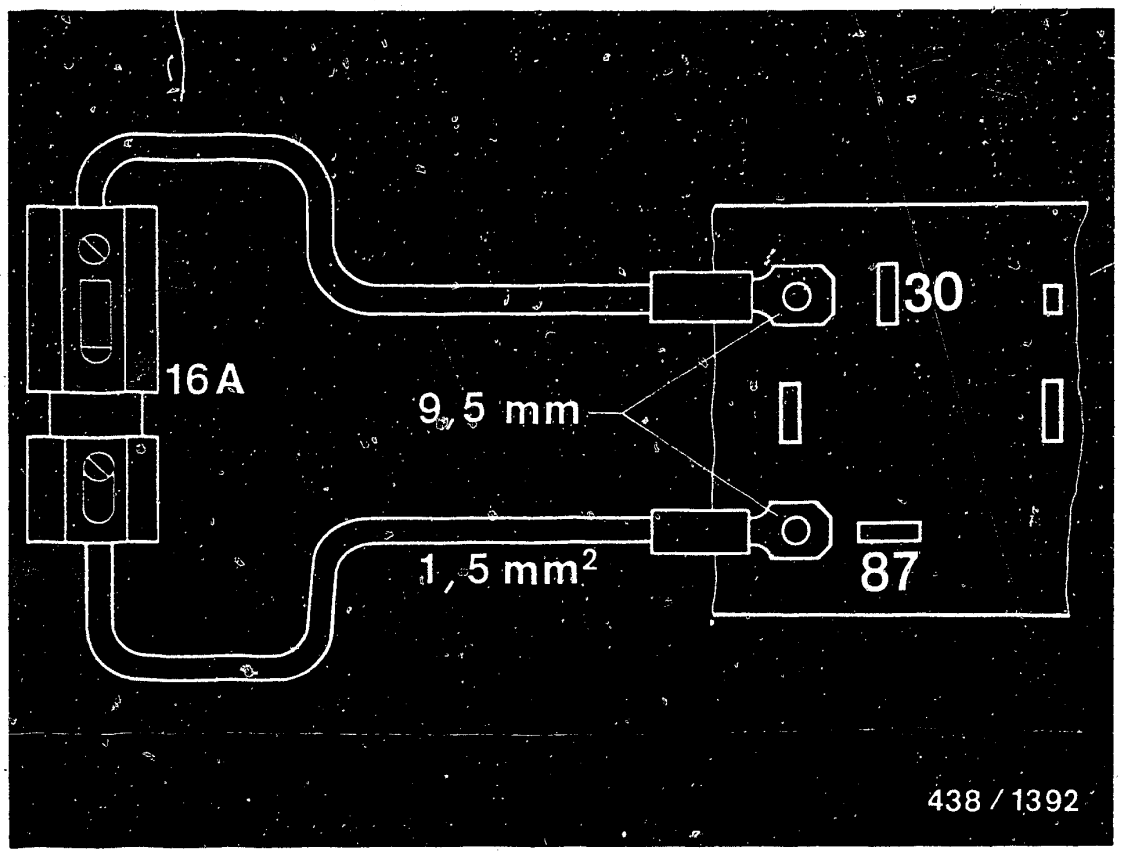
B = Lambda closed-loop control

1 = Electronic relay
2 = Ignition coil
3 = Idle control unit
4 = Idle valve
5 = Start valve
6 = Thermo-time switch
7 = Warm-up regulator
8 = Auxiliary-air device
9 = Electric fuel pump
10 = Main relay
11 = Control unit
12 = Lambda sensor
13 = Throttle-valve switch
14 = Thermo-time switch +25°C
15 = Timing valve
16 = Test connection
17 = Lambda closed-loop tester KDJE-P 600
bl = Blue
rt = Red
sw = Black

3. ELECTRICAL SAFETY CIRCUIT with lambda closed-loop control, control unit 0 280 800 060/.. 061 with 35-pin connection

3.1 Circuit diagram

Idle control unit and idle valve for engine-speed increase if idle speed drops below approx. 700 min^{-1}.

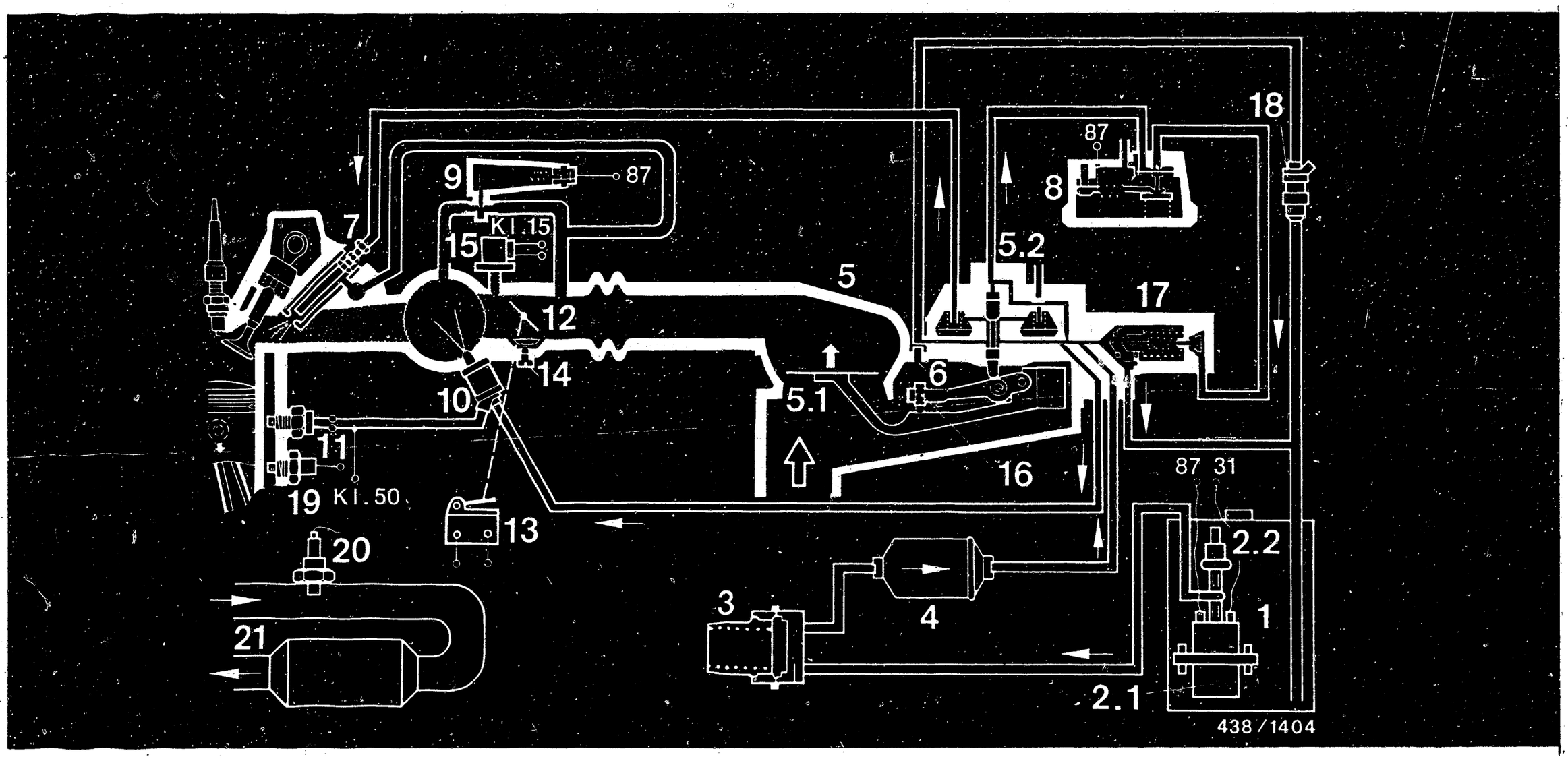


3.2 Jumping the safety circuit for testing

The safety circuit employs an electronic relay which is energized from terminal 1 of the ignition coil.

Pull out electronic relay (on left under instrument panel) from relay board (location 2) and connect contacts 30 and 87 with a jumper.
Electric fuel pump, warm-up regulator and auxiliary-air device are now supplied with battery voltage.

CAUTION!
Never deflect (raise) the air-flow sensor plate with the electric fuel pump operating since otherwise fuel will be injected. Subsequent operation of the starting motor may lead to serious engine damage.



4. DIAGRAM OF FUEL LINES

Fuel lines

Intake-manifold pressure lines

1 = Fuel tank
2.1 = In-tank electric fuel pump
2.2 = Pressure damper
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture-control unit
5.1 = Air-flow sensor
5.2 = Fuel distributor
6 = Anti-tamper cap
7 = Injection valve
8 = Warm-up regulator
9 = Auxiliary-air device
10 = Start valve
11 = Thermo-time switch
12 = Throttle valve
13 = Throttle-valve switch
14 = Bypass screw
15 = Idle valve
16 = Idle-mixture-adjusting screw
17 = Primary-pressure regulator with push valve
18 = Timing valve
19 = Thermo-time switch
20 = Lambda sensor
21 = Catalytic converter

5. GENERAL INFORMATION

5.1 Introduction

The following VW vehicle models with 1.7...1.8 l/4-cylinder engine are supplied with K-Jetronic and lambda closed-loop control:

Jetta, Rabbit, Golf Cabrio	(7.82...6.83) USA Federal and California version
Golf Cabrio	(7.83 →) USA - Japan version
Golf	(3.85 →) USA Federal version

This repair manual refers only to the above-mentioned vehicles and gives a concise description of the testing and adjustment operations to be performed on the vehicle on the K-Jetronic.

All the system components are dealt with in separate working steps with the corresponding test specifications.

In addition to this repair manual the appropriate testing and repair manuals will, of course, be issued for every other vehicle type equipped with the K-Jetronic.

The K-Jetronic differs from other known fuel-injection systems in terms of both construction and operation. In order to be able to carry out the testing procedures described in this manual - and therefore to be able to assess the components - the K-Jetronic and its operation should be clearly understood. The essential points of the operation and construction of the K-Jetronic are described in Technical Instruction VDT-U 3/1 En.

When trouble-shooting the K-Jetronic, it is assumed that the ignition is in order and that the engine is in proper mechanical condition.

The individual test steps of this repair manual are detailed and self-contained. This permits direct trouble-shooting without having to go through the entire test program for each fault.

The trouble-shooting chart on Coordinates B 1 - B 4 is intended to make it easier to decide which test steps have to be carried out for certain faults.

Important note:

If any fuel connections are loosened, parts removed, also on the vacuum system, always use new seals when re-connecting or re-installing.

Ensure utmost cleanliness when working on the K-Jetronic. Fuel connections must be cleaned thoroughly on the outside before opening.

5.2 Design

The overall system of the K-Jetronic in these vehicle models corresponds, with the exception of the differences listed below, to the basic version as described in Technical Instruction VDT-U 3/1 En.

5.3 The following components are different or extra:

- 4-cylinder mixture-control unit with updraft air-flow sensor.
- The inlet-union screw on the fuel filter has a built-in non-return valve. The hexagon is provided with two grooves for identification.
- Safety circuit through electronic engine-speed relay.
- Fuel distributor with push valve integrated in primary-pressure regulator.
- Fuel distributor with adjustable differential-pressure valves. In this version of fuel distributor, screw plugs are situated adjacent to the fittings for the fuel-injection tubing.
  This adjustment possibility was introduced only for production at the factory. This does not therefore result in any additional adjustment possibilities for the after-sales service. The fuel distributor should be treated in precisely the same manner as the normal version. The screw plugs must not be loosened or removed.

As of 1984 model

- Air-shrouded injection valves for better mixture preparation, particularly at idle.
  Air distribution is in the cylinder head.
- Minifilter in inlet-union screw of fuel-distributor inlet.
- Warm-up regulator with altitude compensation.

As of 1985 model

- Injection valves with fixed air-guide cap for air shrouding. Air distribution in cylinder head. To connect these injection valves to the tester for delivered-quantity comparison, adapters KDJE-P 200/19 are required.
- In-tank electric fuel pump with exchangeable non-return valve and screwed-on pressure damper for noise reduction.
- Idle valve 1 for engine-speed increase through air bypass. Switched by idle control unit below 700 min^{-1}.
- Idle valve 2 for engine-speed increase when air conditioner on.

5.4 Other equipment

- For emission control, the vehicles are equipped with lambda closed-loop control and catalytic converter. Important: They must be run only on unleaded gasoline.

If leaded gasoline is used, lambda sensor and catalytic converter will become clogged; the engine power output will fall.

Components of lambda closed-loop control

- Lambda sensor
- Control unit
- Thermo-switch
- Timing valve
- Miles counter
- Warning lamp

6. TEST EQUIPMENT AND TOOLS

- Pressure tester KDJE-P 100 (previously KDEP 1034)
  For testing all fuel pressures and leaks.
- Adjusting wrench KDEP 1035
  For adjusting the idle-mixture-adjusting screw in the mixture-control unit (idle CO adjustment).
- Guide ring KDEP 1040/10 (80 mm dia.)
  For centering the air-flow sensor plate in the air-flow sensor.
- Tester for delivered-quantity comparison KDJE-P 200 (previously KDJE 7451)
  For comparative measurement of fuel deliveries from individual outlets of fuel distributor.
  Adapter KDJE-P 200/19 for injection valves with fixed air-guide cap.
- Electrical connecting lead (test lead)
  KDJE 7450/70 for direct connection of components under test, e.g. start valve.
- Measuring glass (commercially available, approx. 1.5 l capacity)

For measuring delivery of electric fuel pump.

• Electrics tester or multimeter e.g.	ETE 014.00 Philips Miselco Fluke	0 684 101 400 PM 2517 X Master 50K Multimeter 75

- Tool set for fitting and removing the idle anti-tamper device on the air-flow sensor.
  (e.g. No. 4521/7 from Hazet Co. 5630 Remscheid).

- Valve tester KDJE-P 400 (previously KDJE 7452).

  For testing the injection valves.

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, Part Designation VS 14942-CH
Previously Part No. 5 973 340 650
The Bosch calibrating fluid can be obtained in 5 l metal cans from the following supplier:
Firma
Oskar Gnamm GmbH & Co.
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

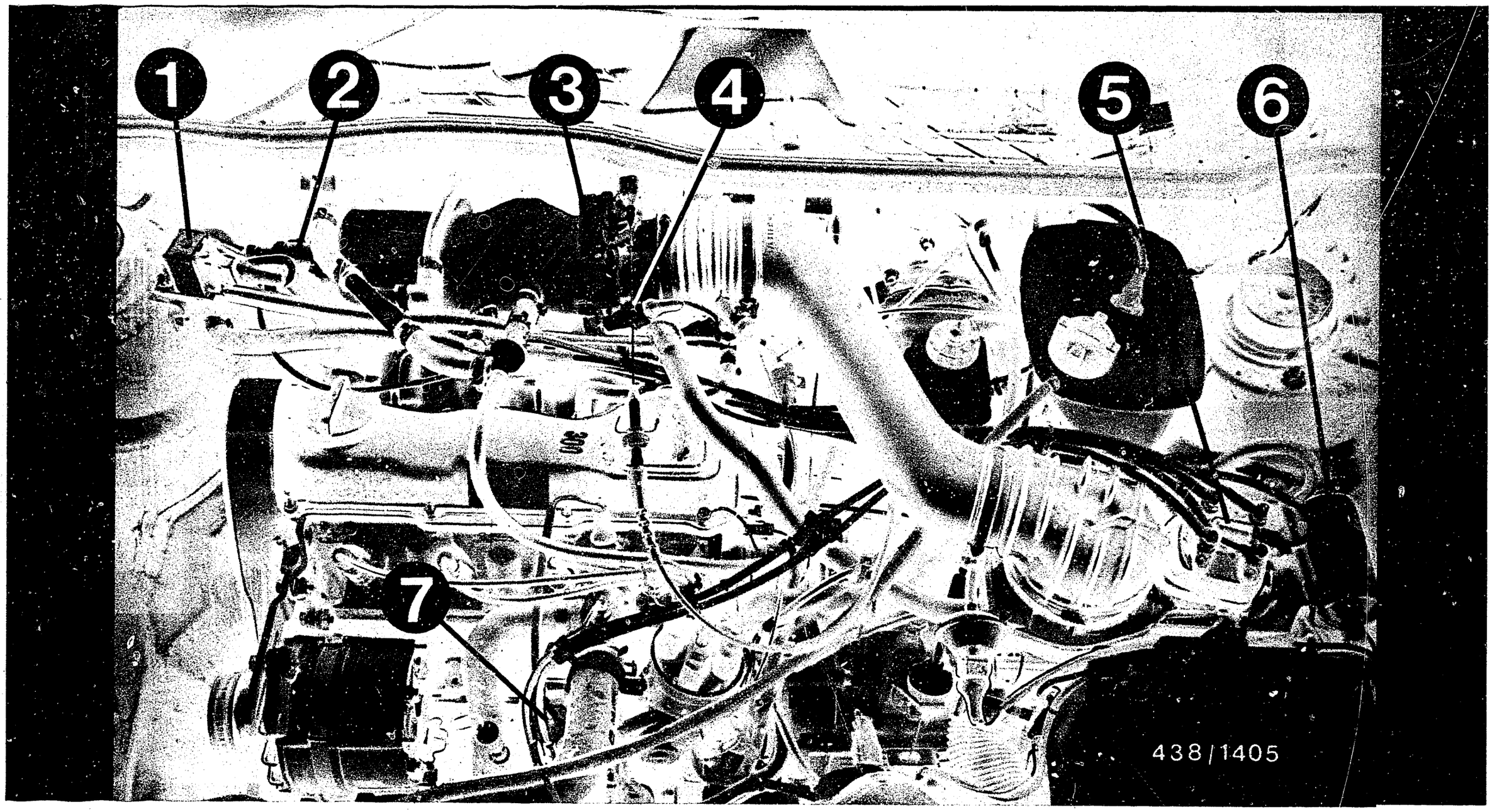
- Tachometer (commercially available)

  For adjusting the idle speed

• Exhaust-gas analyzer:	e.g. ETT 008.00	0 684 100 800
Calibrated testers:	ETT 008.04	0 684 100 804
For idle CO adjustment	ETT 008.05	0 684 100 805

- Lambda closed-loop tester KDJE-P 600

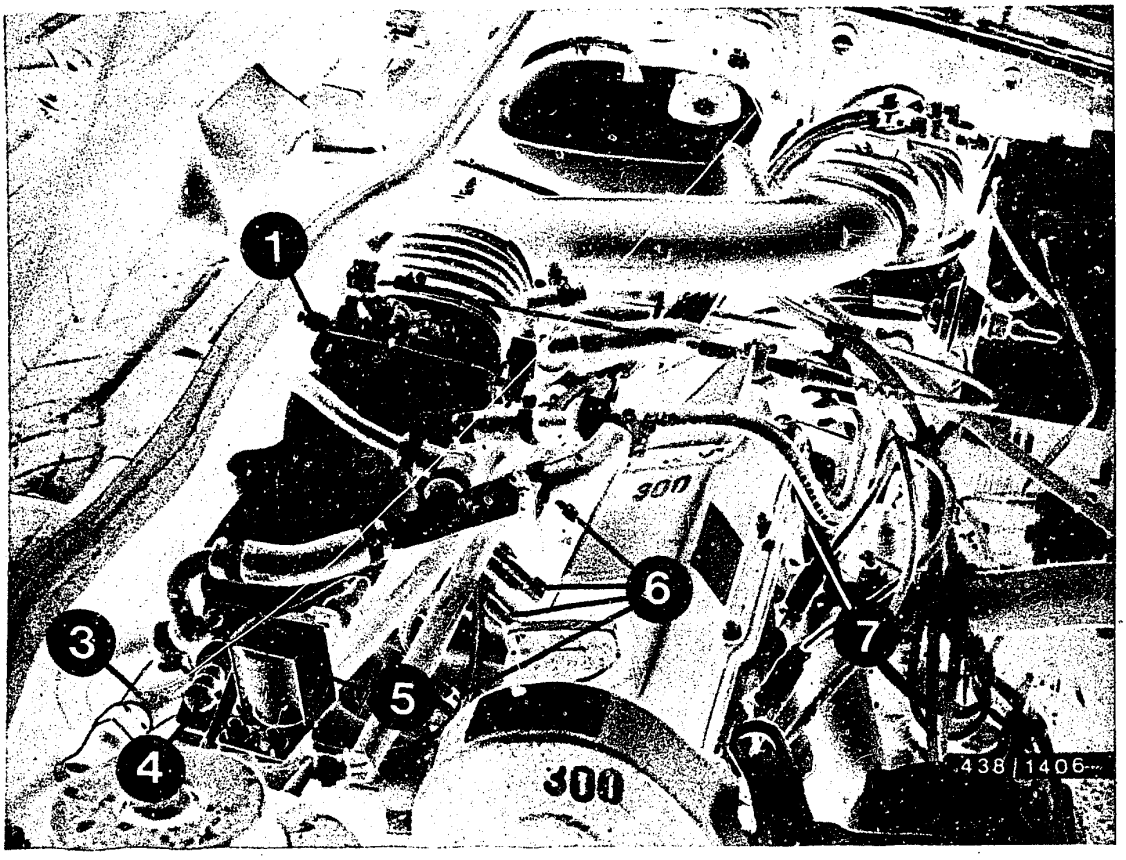
  For measuring on/off ratios of lambda closed-loop control.



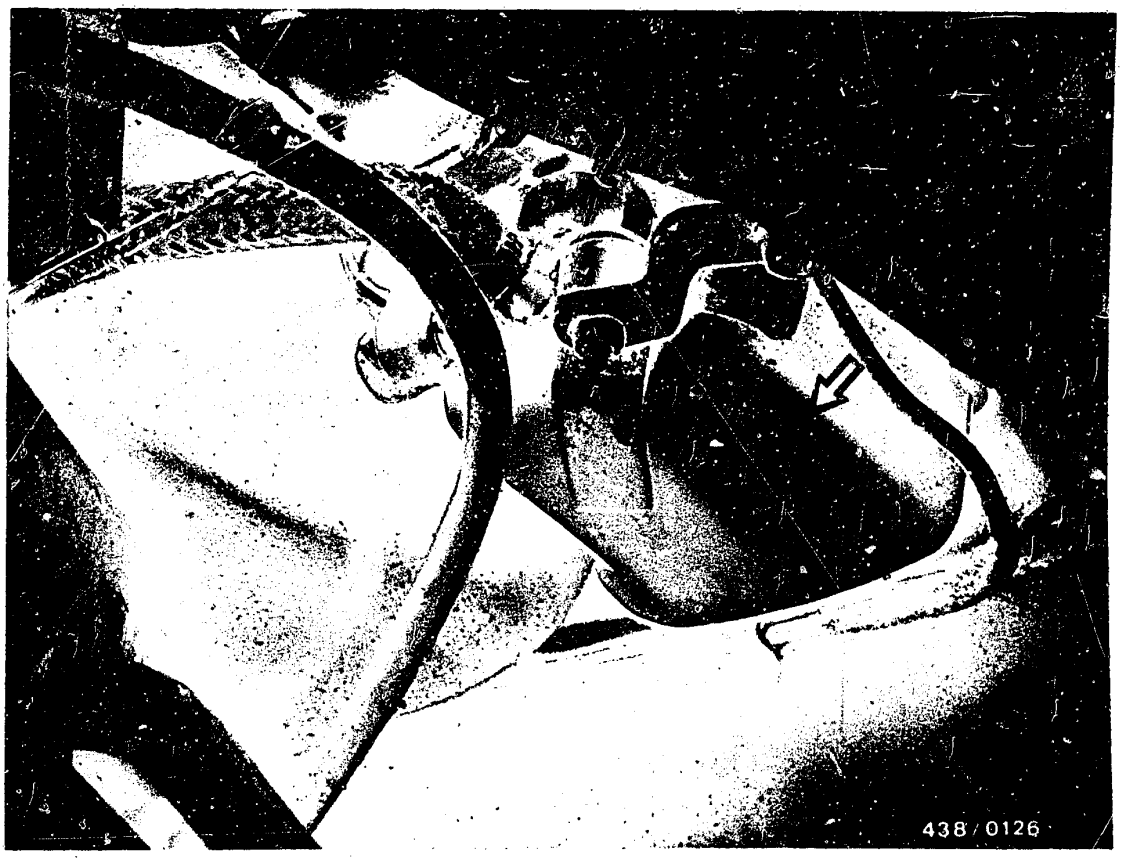
1 = Idle valve
2 = Start valve
3 = Throttle-valve assembly
4 = Throttle-valve switch plug
5 = Mixture-control unit
6 = Fuel filter
7 = Warm-up regulator

7. INSTALLATION POSITION OF INDIVIDUAL COMPONENTS

7.1 Arrangement of components on engine



1 = Idle-speed bypass screw
3 = Auxiliary-air device
4 = Start valve
5 = Idle valve
6 = Injection valves
7 = Thermo-time switch



7.2 Fuel-supply components

- Up to 1984 model:
  The electric fuel pump is mounted by a bracket on the vehicle floor in front of the rear axle (on the right-hand side as viewed in the forward direction of travel).
  It is made accessible by removing the dirt-protection plate (arrow).
- As of 1985 model:
  The in-tank electric fuel pump with replaceable non-return valve and screwed-on pressure damper is accessible through the closure ring on the top side of the fuel tank.

8. Trouble-shooting chart

When trouble-shooting the K-Jetronic, it is assumed that the ignition is in order and that the engine is in proper mechanical condition.

The individual test steps of this repair manual are detailed and self-contained. This permits direct trouble-shooting without having to go through the entire test program for each fault.

The trouble-shooting chart on Coordinates B 2 - B 5 is intended to make it easier to decide which test steps have to be carried out for certain faults.

According to the symptom stated by the customer or which you yourself have determined, select the possible cause in the trouble-shooting chart. The coordinate at the end of the cause column refers to the appropriate test step with the associated test specification.

Important note:

If any fuel connections are loosened, parts removed, also on the vacuum system, always use new seals when re-connecting or re-installing.

Ensure utmost cleanliness when working on the K-Jetronic. Fuel connections must be cleaned thoroughly on the outside before opening.

Trouble-shooting chart (see also Coordinates B4/B5)

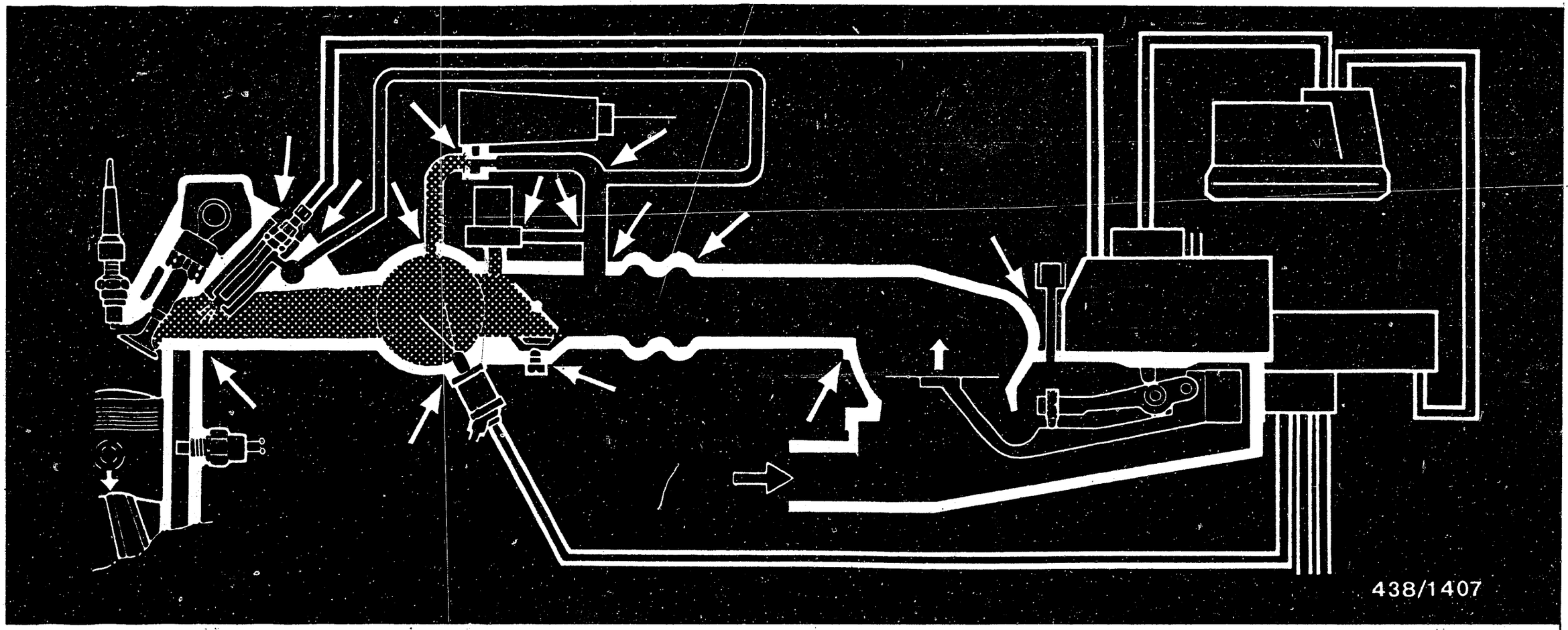
Customer complaint (fault symptom)

1. Engine fails to start or starts only with difficulty when cold	2. Engine fails to start or starts only with difficulty when warm; hot-starting difficulties*	3. Rough idle during warm-up (shaking)	4. Rough idle when engine warm (shaking)	5. Poor throttle take-up; engine coughing	6. Engine missing during vehicle operation, high load	7. Unsatisfactory performance	Cause	Coordinates
	●	●	●	●		●	Air-intake system leaking	B 6
●	●		●	●	●	●	Air-flow sensor lever/control plunger stiff	B 8
	●						Position of air-flow sensor plate incorrect	B 18
●		●					Auxiliary-air device not opening	B 22
●	●				●		Electric fuel pump not operating	C 1
●	●						Cold-starting system defective	C 5
		●	●				Start valve leaking	C 5
				●			Excessive fuel delivery for control-pressure circuit	D 4
●		●					"Cold" control pressure not within tolerance	D 1
	●		●	●	●	●	"Warm" control pressure (after cut-back) too high	D 1
			●	●		●	"Warm" control pressure (after cut-back) too low	D 1
					●	●	Primary pressure not within tolerance	E 1
	●						Overall fuel system leaking	F 1
●	●	●	●		●		Injection valves leaking; opening pressure too low	G 1
●	●	●	●			●	Uneven fuel deliveries (fuel delivery scatter)	G 10
●	●	●	●	●			Basic idle adjustment incorrect	H 1
						●	Throttle valve not opening fully	---
		●	●	●		●	Lambda closed-loop control defective	J 1

* Note:
If, with fault symptom 2, after checking and remedying all below-listed causes, the warm-starting performance is still unsatisfactory, it is possible to make an improvement by installing a pulse relay. This is described on Coordinate N4.

Trouble-shooting chart (see also Coordinates B2/B3)
Customer complaint (fault symptom) (continued)

8. Engine runs on ("diesels")	9. Fuel consumption too high	10. Flat spot on acceleration	11. CO concentration at idle too high	12. CO concentration at idle too low	13. Idle speed not adjustable (too high)	14. Engine starts but then dies again immediately	Cause	Coordinates
		●		●			Vacuum system leaking	B 6
●		●	●	●			Air-flow sensor lever/control plunger stiff	B 8
●							Position of air-flow sensor plate incorrect	B 18
					●		Auxiliary-air device not closing	B 22
						●	Electric fuel pump not operating	C 1
●	●		●				Start valve leaking	C 5
		●				●	Excessive fuel delivery for control-pressure circuit	D 4
		●				●	"Warm" control pressure (after cut-back) too high	D 1
	●	●	●			●	"Warm" control pressure (after cut-back) too low	D 1
		●				●	Primary pressure not within tolerance	E 1
●							Injection valves leaking; opening pressure too low	G 1
		●					Uneven fuel deliveries (fuel delivery scatter)	G 10
●	●	●	●	●	●		Basic idle adjustment incorrect	H 1
	●	●	●	●			Lambda closed-loop control defective	J 1



TEST STEPS

9. CHECKING THE AIR-INTAKE SYSTEM OF THE ENGINE FOR LEAKS

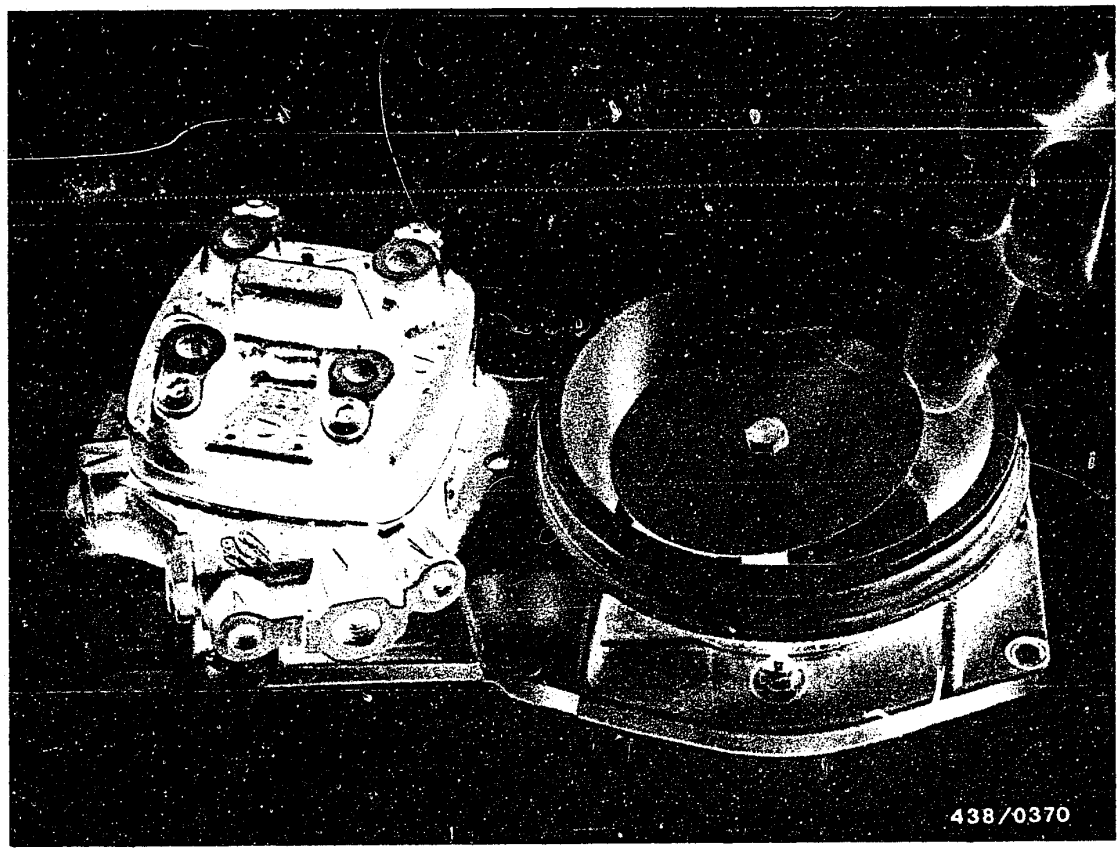
The arrows in the picture identify the typical points at which leaks may occur. Check by means of visual examination or, if unsure, as follows: Disconnect hose from outlet of auxiliary-air device and, using a compressed-air gun, blow air through this hose into the intake system. Open throttle valve fully when doing this. Brush joints with soapy water or spray with leak detector (e.g. Güpoflex).
Under no circumstances may combustible liquids be used for the leak test.
Bubbling or foaming indicates a leak.
When checking for leaks, pay particular attention to O-rings and insulating sleeves of injection valves. If necessary, tighten with angled hexagon screwdriver. When a leak has been remedied, it is necessary finally to make the idle adjustment with the engine at normal operating temperature.
Idle adjustment is described on Coordinate H 1.

10. CHECKING THE CONTROL LEVER IN THE AIR-FLOW SENSOR AND THE CONTROL PLUNGER IN THE FUEL DISTRIBUTOR FOR FREEDOM OF MOVEMENT

10.1 Preparations

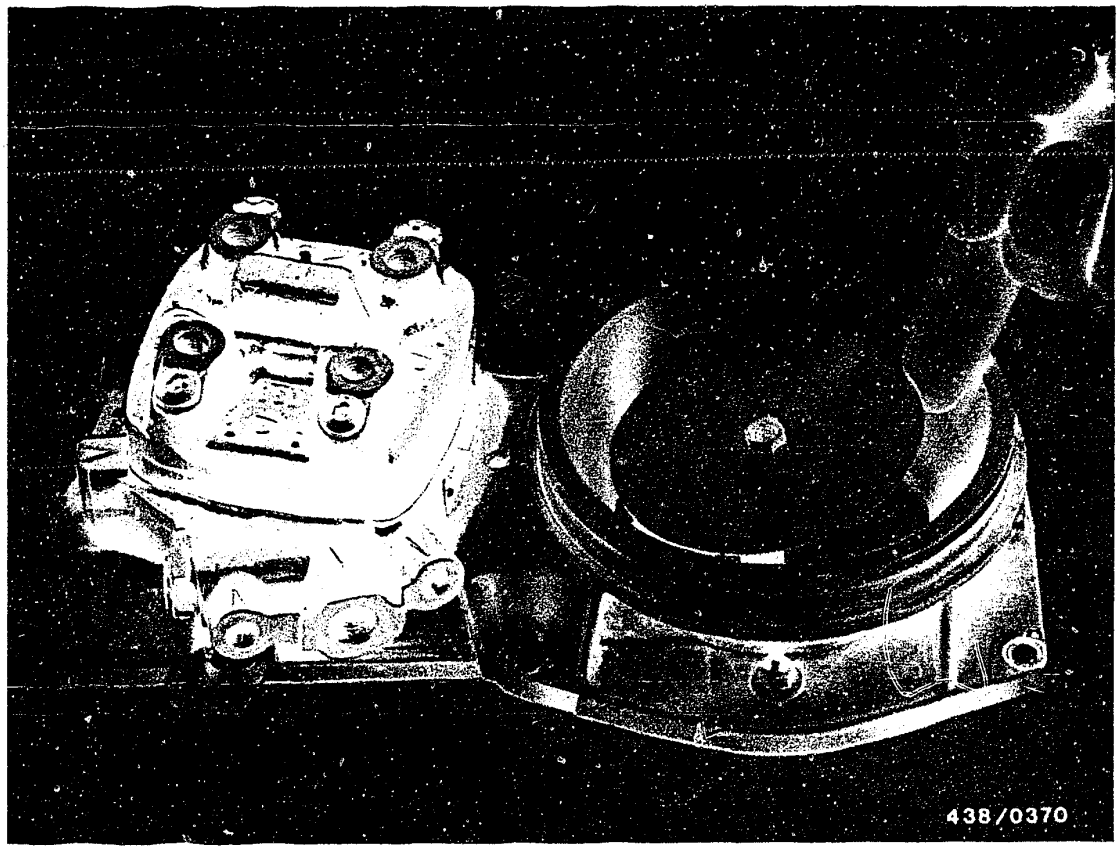
- Engine temperature not below +20° C.
- Remove the rubber hood (loosen clamping bands) so that the air-flow sensor plate becomes accessible.
- Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
  This results in application of the control pressure to the control plunger in the fuel distributor.

CAUTION!
Never deflect (raise) the air-flow sensor plate with the electric fuel pump running since otherwise fuel will be injected. Subsequent operation of the starting motor may lead to serious engine damage.



10.2 Check that the control lever moves freely

Raise the air-flow sensor plate by hand (updraft) and release again.
The sensor plate snaps back into the zero position and bounces up about twice from the spring-loaded stop.
If the control lever does not move freely, first release all fastening screws holding the air-flow sensor to determine whether housing deformation is the cause of the problem.
If the problem is solved by loosening the fastening screws, the seal between the air-supply housing and air-flow sensor should be changed (VW parts).
Tighten the screws uniformly cross-wise to a torque of 9...10 Nm (0.9...1.0 kgfm).
If the housing is not deformed, then the air-flow sensor must be repaired or replaced.



10.3 Check that the control plunger moves freely.

Raise the air-flow sensor plate by hand (updraft). The same resistance must be felt over the entire movement.

Move the sensor plate rapidly back to a position just in front of the zero stop. The control plunger follows only sluggishly, but must make noticeable contact with the sensor plate lever. If this condition is fulfilled, the control plunger can be considered to move freely.

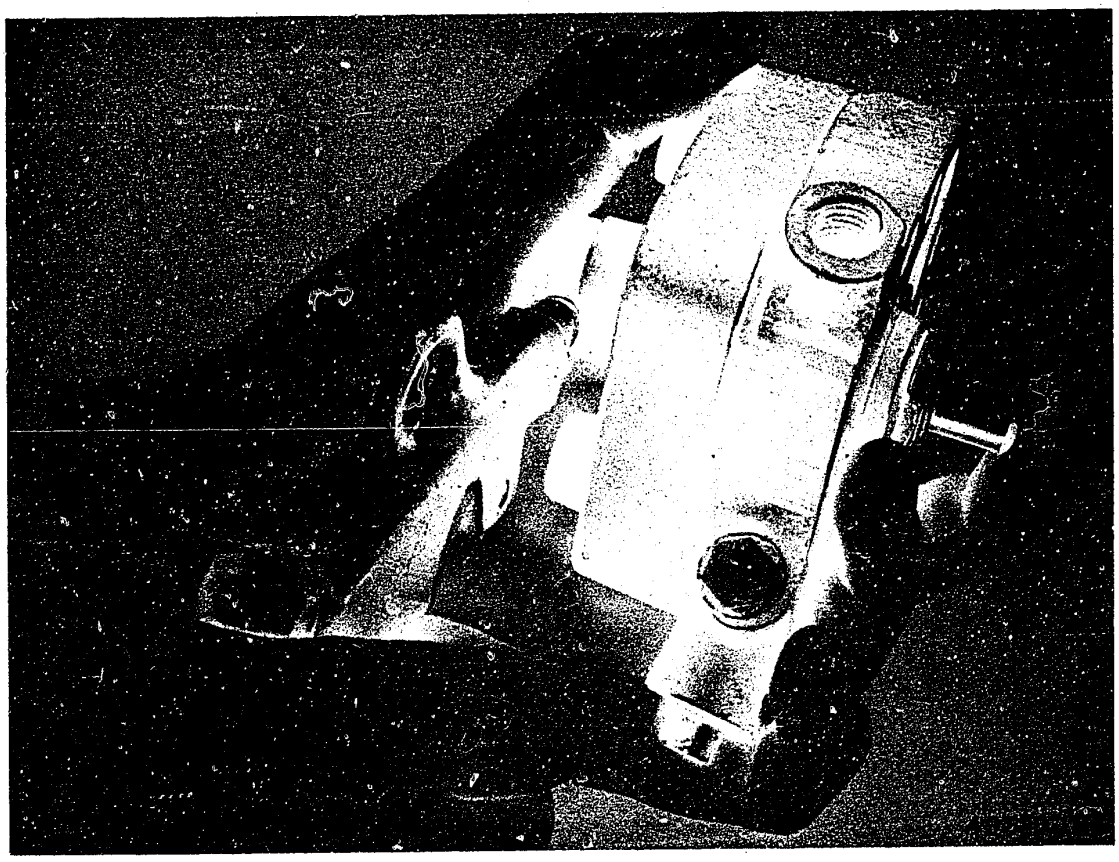
If the control plunger does not move freely, remove the fuel distributor from the air-flow sensor.

Important!
Note the following when installing fuel components and fuel lines:

Always ensure utmost cleanliness when loosening or tightening the fuel connections. No dirt must enter the fuel system.

When loosening or tightening the fuel connections, apply counter-force at the fixed hexagon of the component.

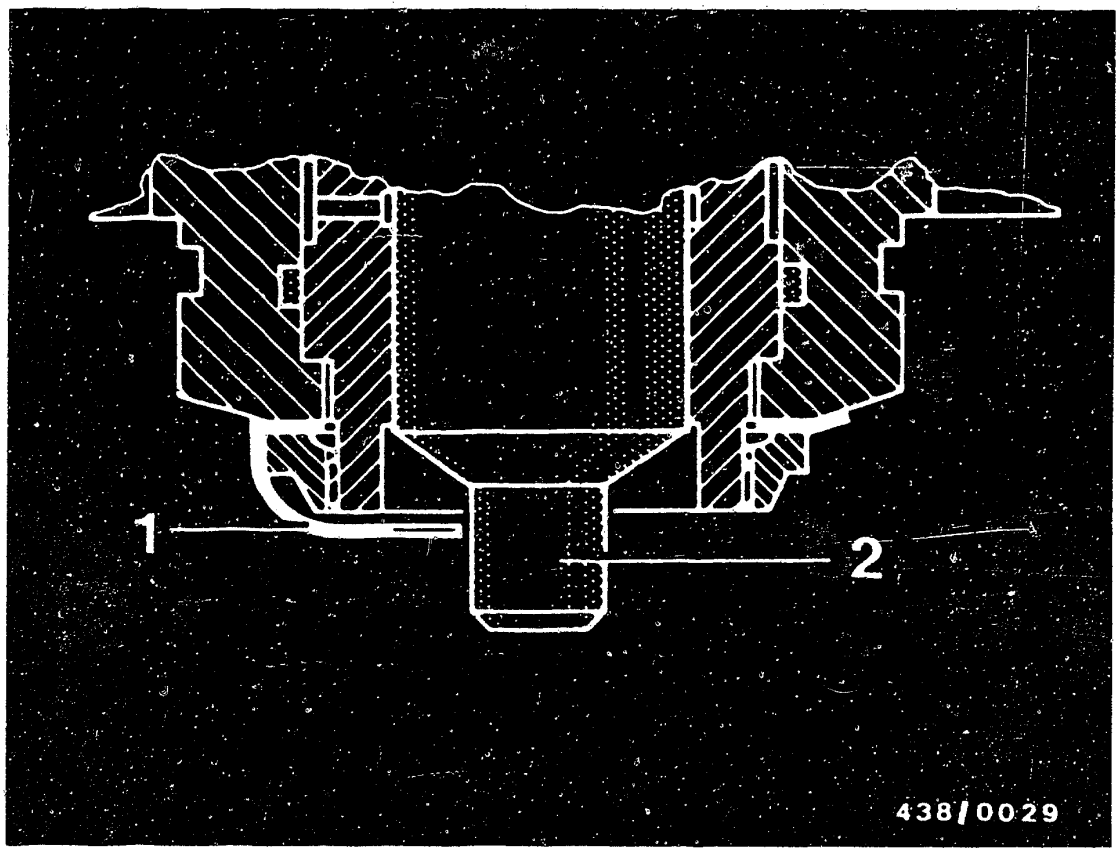
Clean the fuel distributor thoroughly in the region of the fuel connections. Screw off all connections.



Screw out three fastening screws and remove the fuel distributor from the air-flow sensor.

Remove the plunger. Under certain conditions in order to do this it may be necessary to blow compressed air briefly against the plunger through the control-pressure connection hole. Hold the plunger with your hand while doing this. Clean the plunger thoroughly with Benzine. If the plunger still does not move freely, replace the fuel distributor.

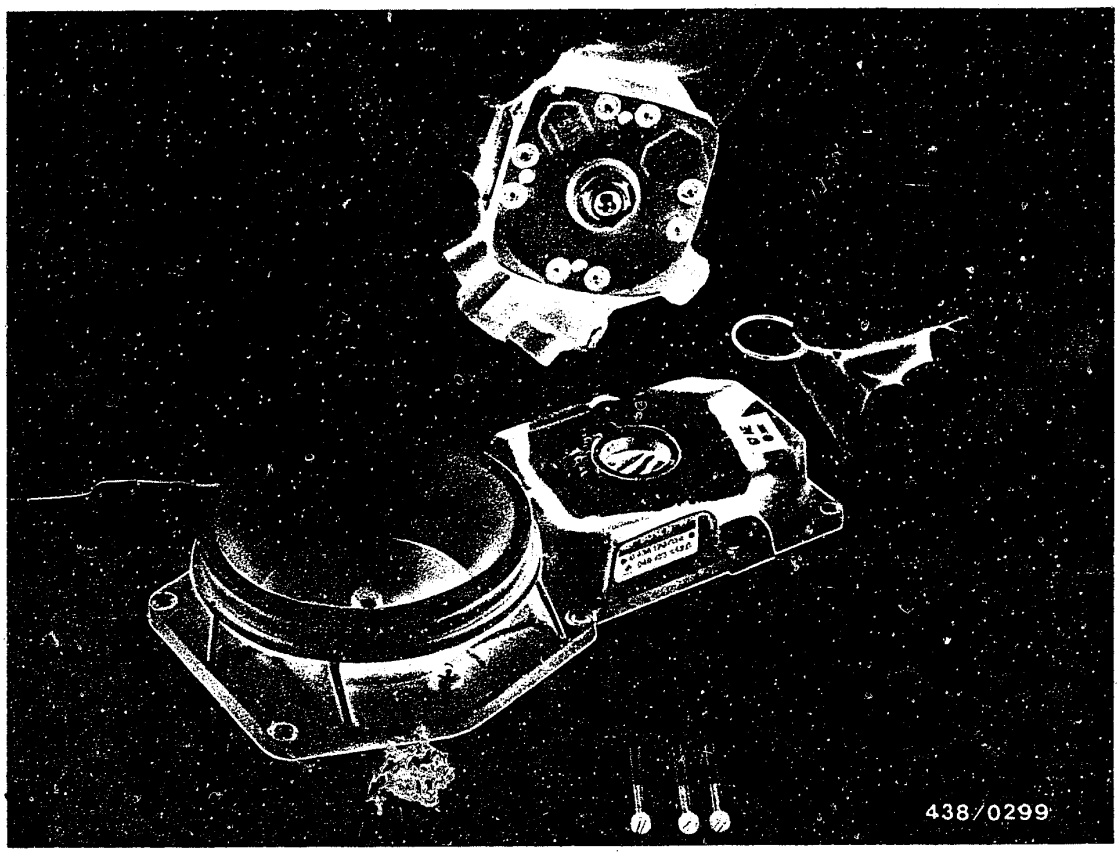
Caution!
Some fuel distributors are additionally equipped with a compression spring above the control plunger and with a drop-out safeguard.
When removing the control plunger, firstly bend up the drop-out safeguard, pay attention to the compression spring and re-insert them when assembling.



1 = Drop-out safeguard
2 = Control plunger

10.4 Fuel distributor with drop-out safeguard for the control plunger

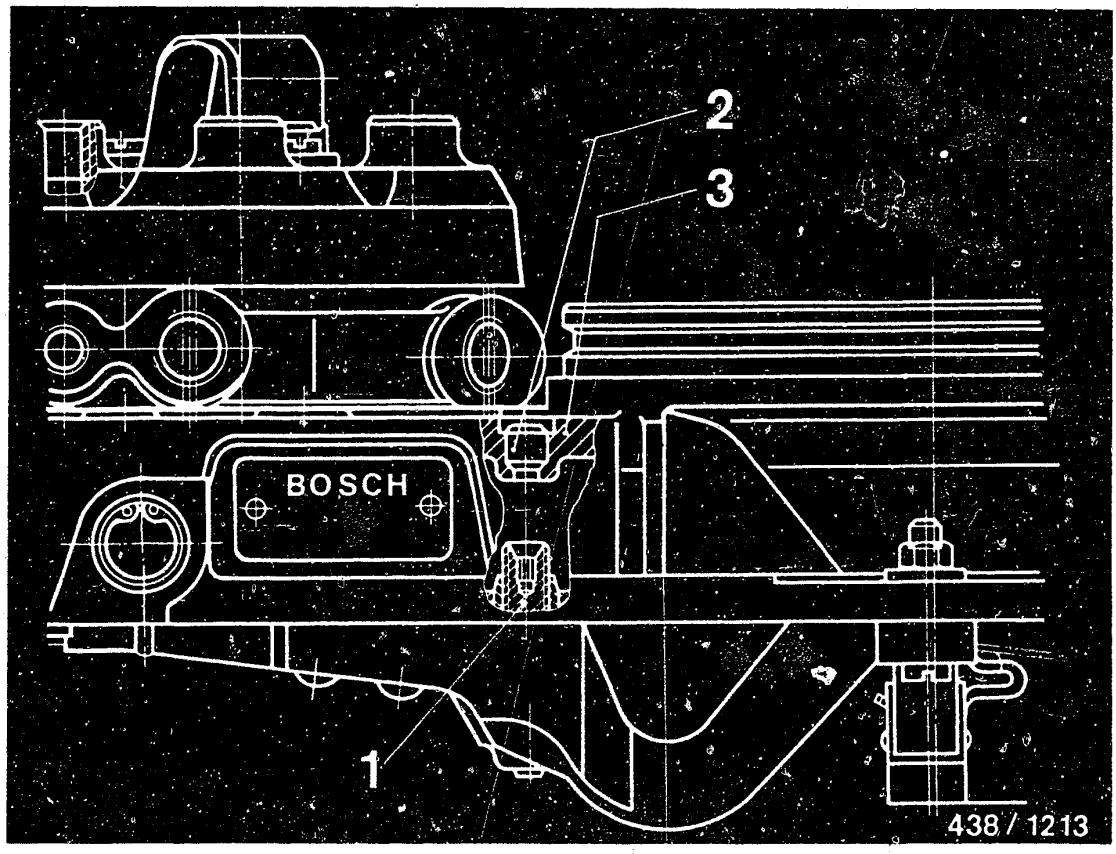
Caution!
The fuel distributors have a drop-out safeguard for the control plunger.
This metal safeguard also serves as an in-transit protection device and facilitates assembly.
The drop-out safeguard must not be removed.



10.5 Fitting the fuel distributor

When fitting the fuel distributor, use a new seal ring between fuel distributor and air-flow sensor. Observe the tightening torque 3.2...3.8 Nm (0.32... 0.38 kgfm) for the fastening screws precisely.

When connecting the fuel-injection tubing, use new seal rings.



1 = Mixture-control screw
2 = Guide tube
3 = Lead seal

10.6 Matching the fuel distributor to the air-flow sensor for initial starting

Screw off one fuel-injection line from the fuel distributor. Bridge the electrical safety circuit so that the electric fuel pump operates.

A steel tab is inserted at the bottom of the aluminum plug in order to prevent complete penetration by the pilot drill.

The aluminum plug has the following order number: 2 437 001 009.

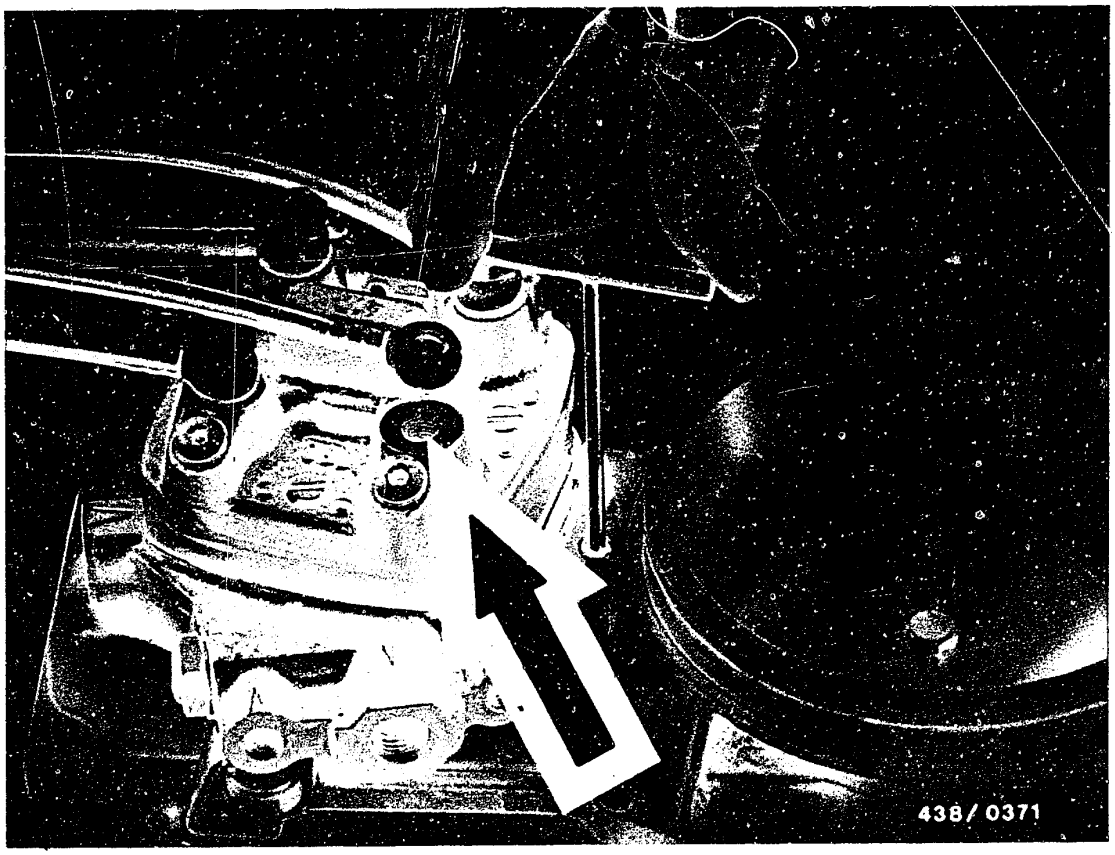
- Setting the idle mixture screw

Unscrew one of the injection lines at the fuel distributor. Bridge the electrical safety circuit so that the electric fuel pump will operate.

The idle mixture screw can be set via the access hole in the air flow sensor.

Insert adjusting wrench KDEP 1035 into the idle mixture screw.

CAUTION!
Never deflect (raise) the air-flow sensor plate with the electric fuel pump running since otherwise fuel will be injected. Subsequent operation of the starting motor may lead to serious engine damage.

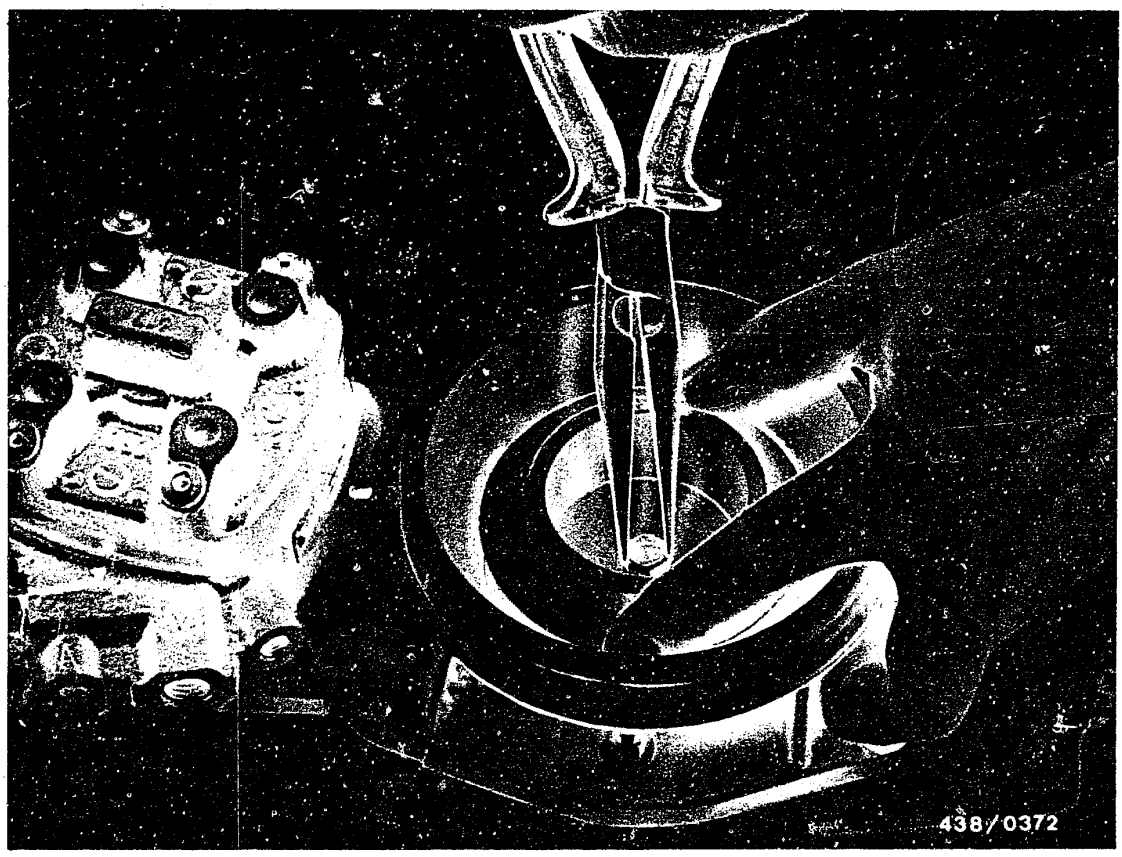


Screw in the idle-mixture-adjusting screw slowly and without exerting any great pressure on the adjusting wrench until fuel is just delivered from the open outlet (arrow) of the fuel distributor. Then turn back the idle-mixture screw by 1/2 turn.

Re-connect the fuel-injection line to the fuel distributor, start the engine and warm up.

The final matching of air-flow sensor and fuel distributor is carried out by adjusting the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinates H 1.



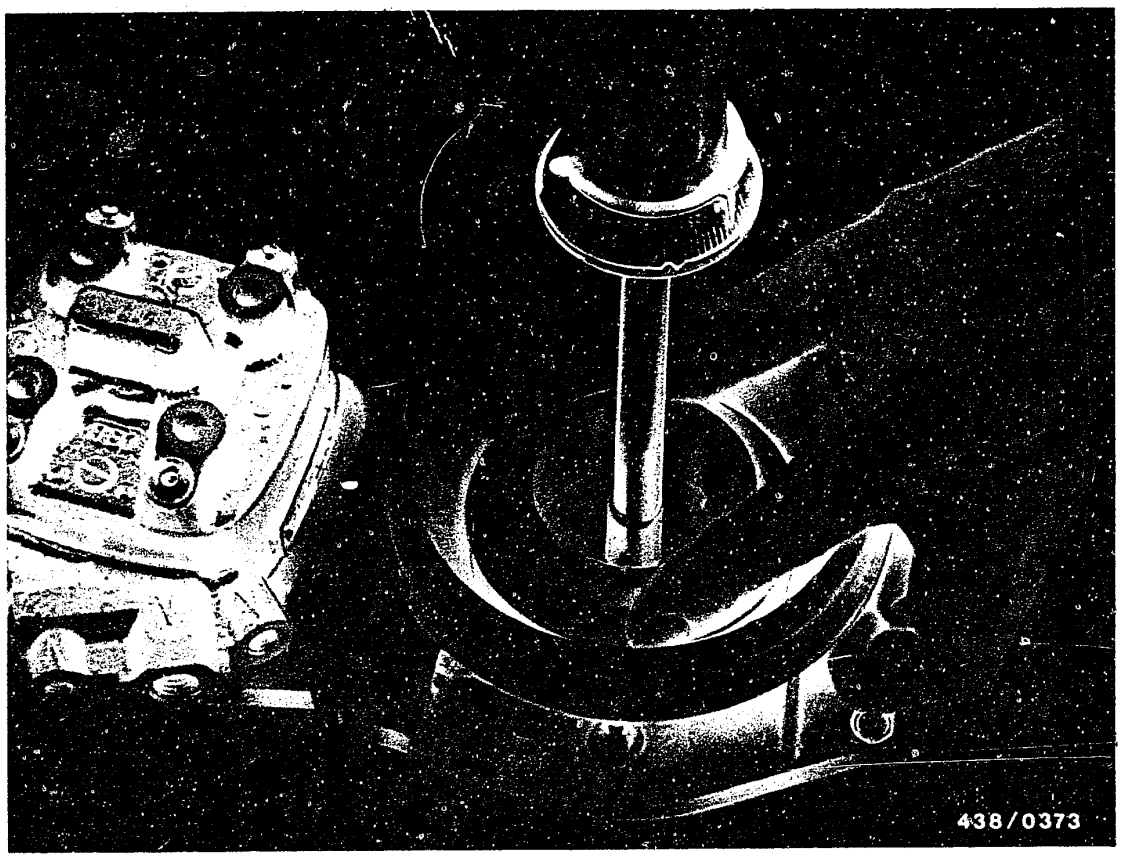
11. Checking and adjusting the position of the air-flow sensor plate

11.1 Preparations

- Engine temperature is not important.
- Remove the rubber hood from the air-flow sensor (release 2 clamping bands), so that the air-flow sensor plate becomes accessible.

11.2 Centering the air-flow sensor plate

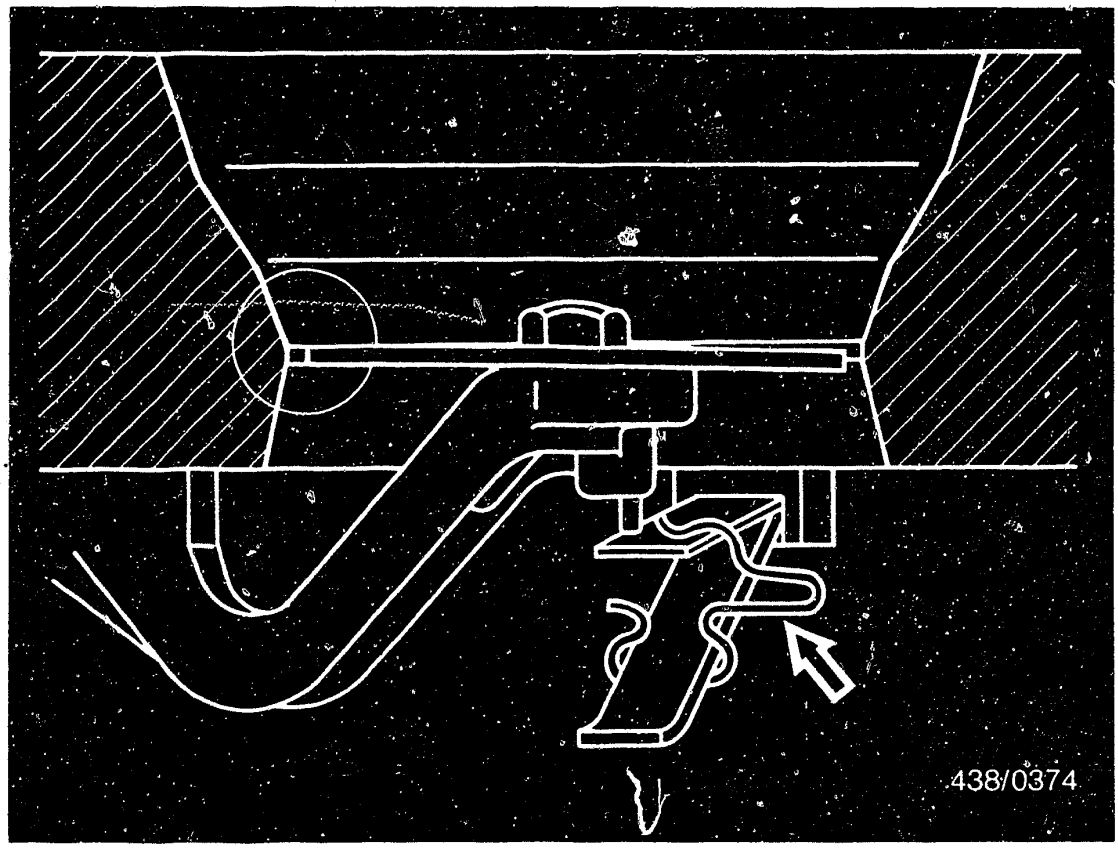
Check that the sensor plate is flat (not bent) and that it can move through the narrowest part of the air funnel without touching the funnel. If necessary, center it using a positioning ring KDEP 1040/10 (dia. 80 mm) as follows:



Loosen the sensor plate fastening screw. Insert the positioning ring while holding the fastening screw with pliers so that the sensor plate does not deflect downwards.

With the positioning ring in place, tighten the fastening screw with a torque of 5.0...5.5 Nm, loosen again and tighten again with the same torque.
When tightening the screw make sure that the air-flow sensor plate is in its zero position (in the cylindrical part of the air funnel).

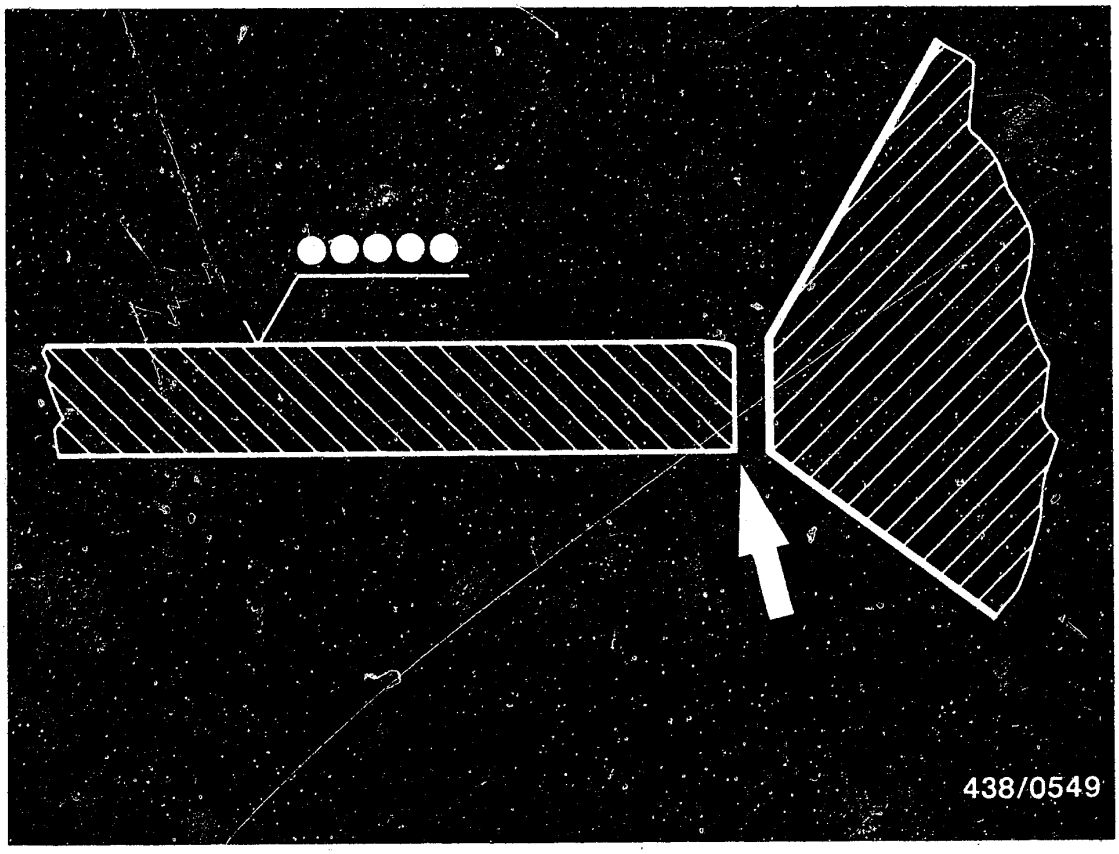
It must no longer be possible to turn the air-flow sensor plate by hand.



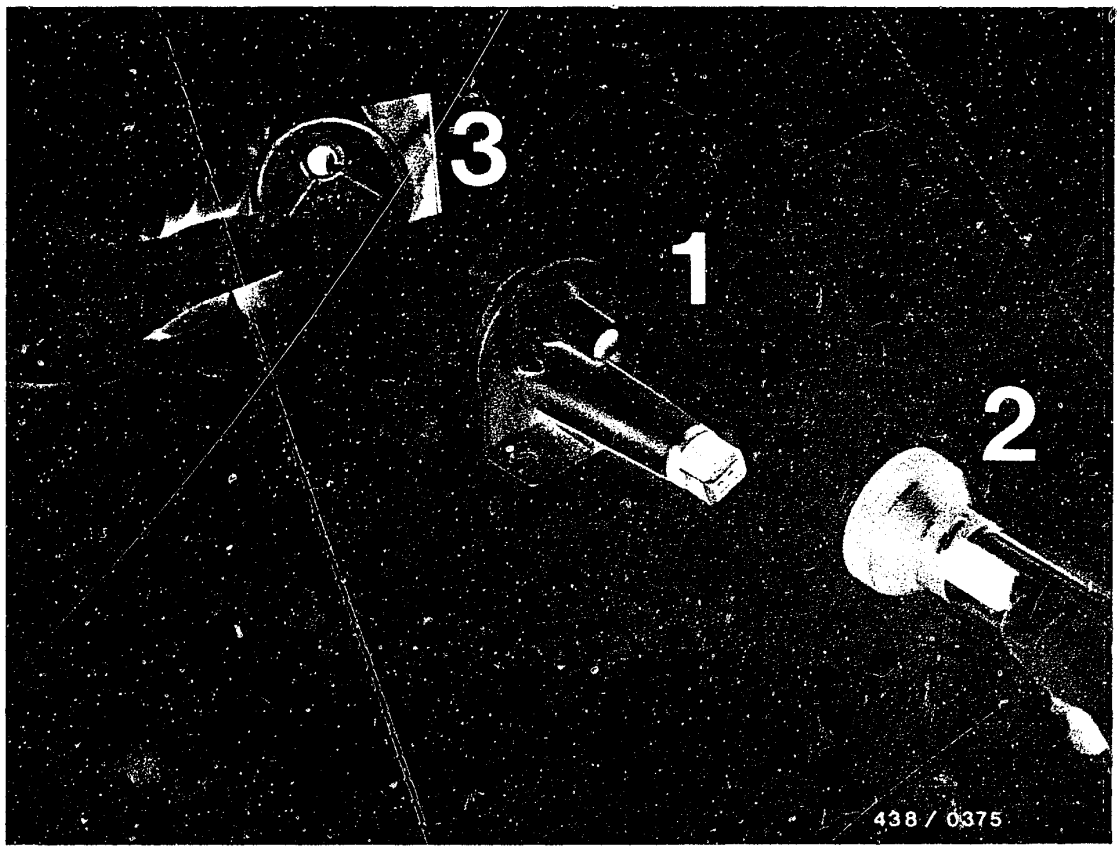
11.3 Checking and adjusting the zero position of the sensor plate (rest position):

Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.

The upper edge of the sensor plate must be flush with the beginning of the cone in the position shown in the picture. A lower position of up to maximum 0.5 mm is permissible, however the air-flow sensor plate must not project at any point on its circumference outside the cylindrical part of the air funnel.
If necessary, the position of the air-flow sensor plate can be adjusted by bending the shaped spring (arrow).



Caution:
Be sure that sensor plate is mounted in correct position! Its upper side is identified by five punch marks (in a row).
The sharp edge (arrow) is at the bottom.



1 = Auxiliary-air device
2 = Flashlight
3 = Mirror

12. Checking the operation of the auxiliary-air device

The engine must be cold.
Disconnect the electric cable plugs from the auxiliary-air device and warm-up regulator.
Disconnect both air hoses from the auxiliary-air device.
Since the two hose fittings on the auxiliary-air device are located exactly opposite each other, a visual check can now be made to see if the blocking plate is partially open. It will be easier to look through the auxiliary-air device with the aid of a flashlight and a mirror, as shown in the illustration.

If an opening is not visible with the engine cold, replace the auxiliary-air device.

Fit the electric cable plug on the auxiliary-air device.

By bridging the electrical safety circuit, supply power to the auxiliary-air device.
After a maximum of 10 minutes, the opening in the auxiliary-air device must be completely closed by the blocking plate.

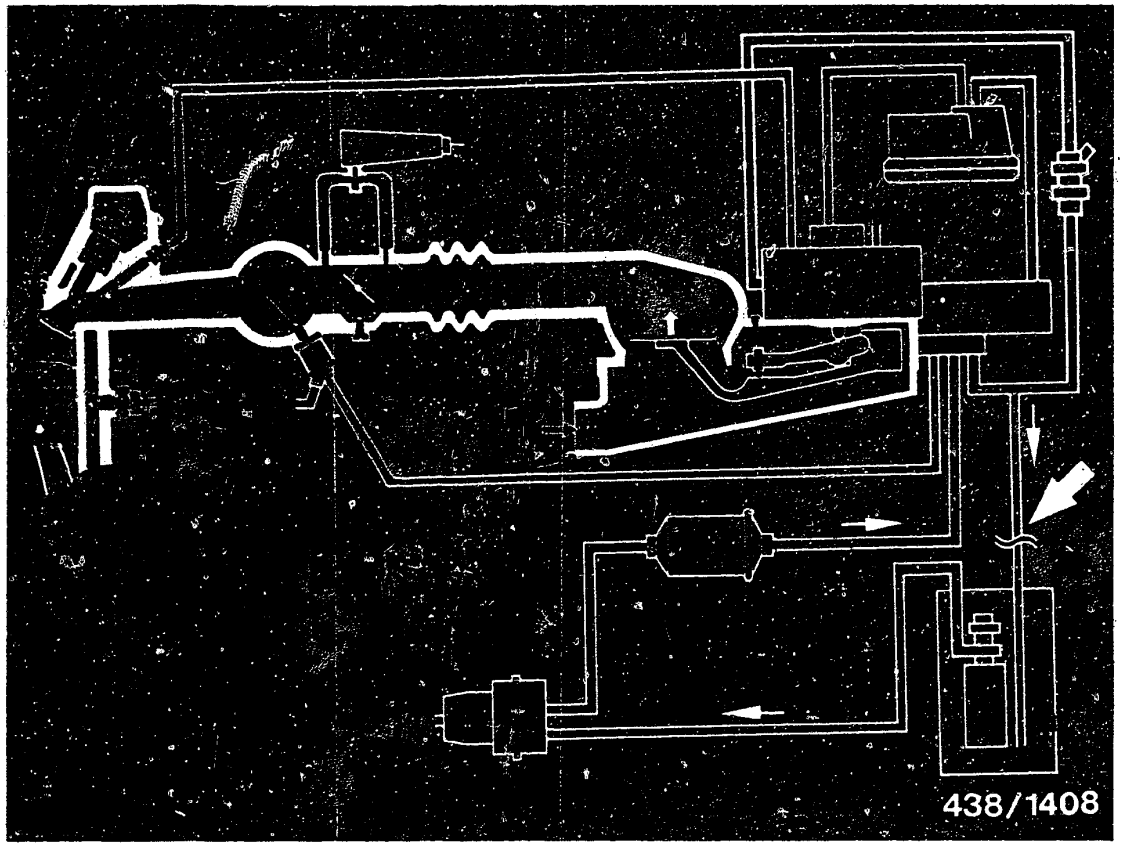
If the blocking plate does not close, check the power supply (open circuit, voltage drop).
Minimum voltage across the connector 11.5 V with the engine stopped.

If these points are O.K., check the heating coil of the auxiliary-air device for an open circuit using an ohmmeter.

Replace the auxiliary-air device if defective.

When the auxiliary-air device has been replaced, readjust the idle speed.

Idle adjustment is described on Coordinates H 1.



13. Checking the operation of the electric fuel pump.

13.1 Requirement

Conclusive information on the operation of the electric fuel pump can only be given by a measurement of fuel delivery under pressure, i.e. under primary (system) pressure. This measurement must therefore be made at the return line leading to the fuel tank (arrow).

13.2 Measuring point:

A suitable measuring point for fuel-delivery testing is the screw connector (arrow) in the fuel return line to the fuel tank.

Before loosening the lower connector, vent the fuel tank by opening the tank filler cap.
Fit the test hose with an annular connection piece and connect to the return hose of the fuel distributor with inlet-union screw M 14x1.5 as well as copper seal rings.

Hold the end of the hose in a graduate (approx. 1.5 litres capacity) in order to make the measurement.

13.3 Testing:

Disconnect plugs from warm-up regulator and auxiliary-air device.

Switch on electric fuel pump for precisely 30 seconds by jumping the safety circuit and measure the fuel delivery in the measuring glass.

Caution!

Never deflect (raise) the air-flow sensor plate with the electric fuel pump running since otherwise fuel will be injected. Subsequent operation of the starting motor may lead to serious engine damage.

13.4 Test specification:

Fuel delivery: Min. 750 cm^3/30 seconds

13.5 Possible causes of fuel delivery being too low

- Power supply to electric fuel pump not O.K., voltage drop. Necessary minimum voltage at terminals = 11.5 V with electric fuel pump on.
- Fuel filter very dirty.

As of 1984 model:

- Minifilter in inlet-union screw of fuel-distributor inlet dirty.

If the above-mentioned points are O.K., the cause lies with the electric fuel pump itself.
Replace electric fuel pump.

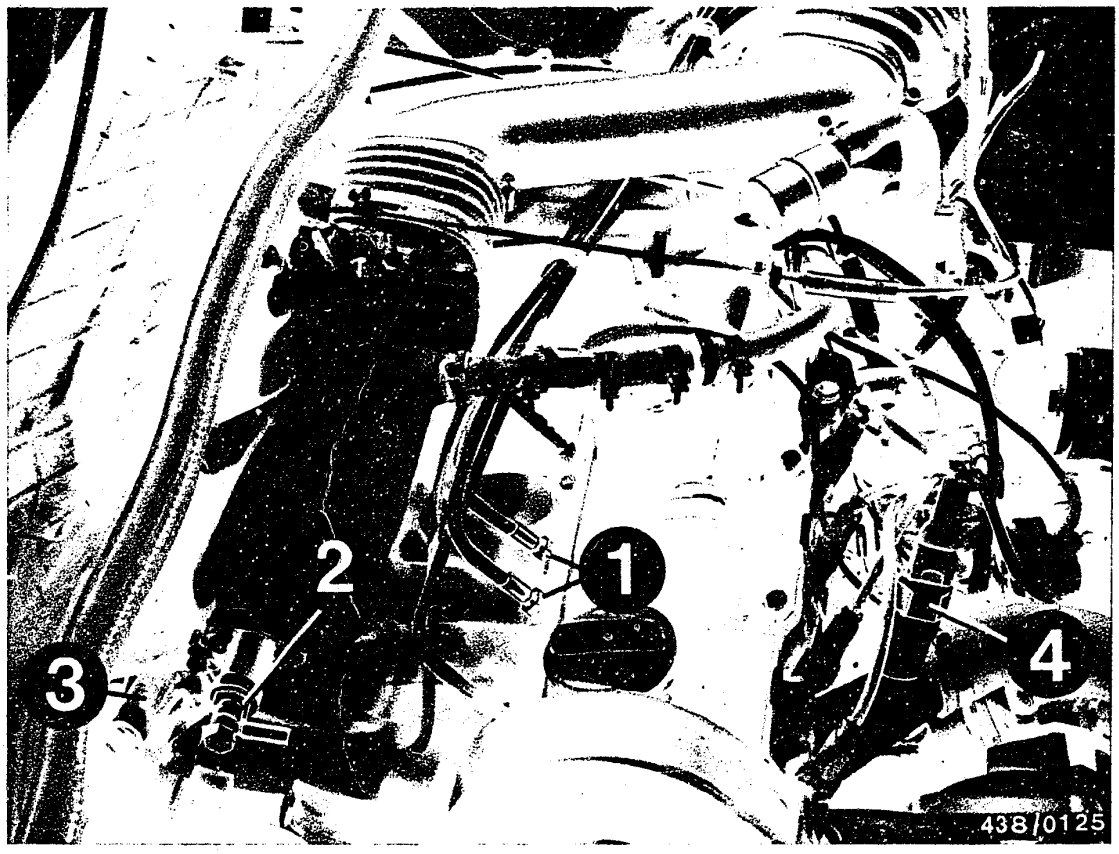
13.6 Removing and installing the electric fuel pump:

To do this, pinch off fuel intake hose from fuel tank to electric fuel pump (e.g. using hose clamper W 157 from Matra).

- As of 1985 model

The in-tank electric fuel pump with screwed-on pressure damper is accessible through a closure ring at the top on the fuel tank.

When installing, use a new seal and ensure the correct position of the electric fuel pump. Danger of fuel lines being kinked.

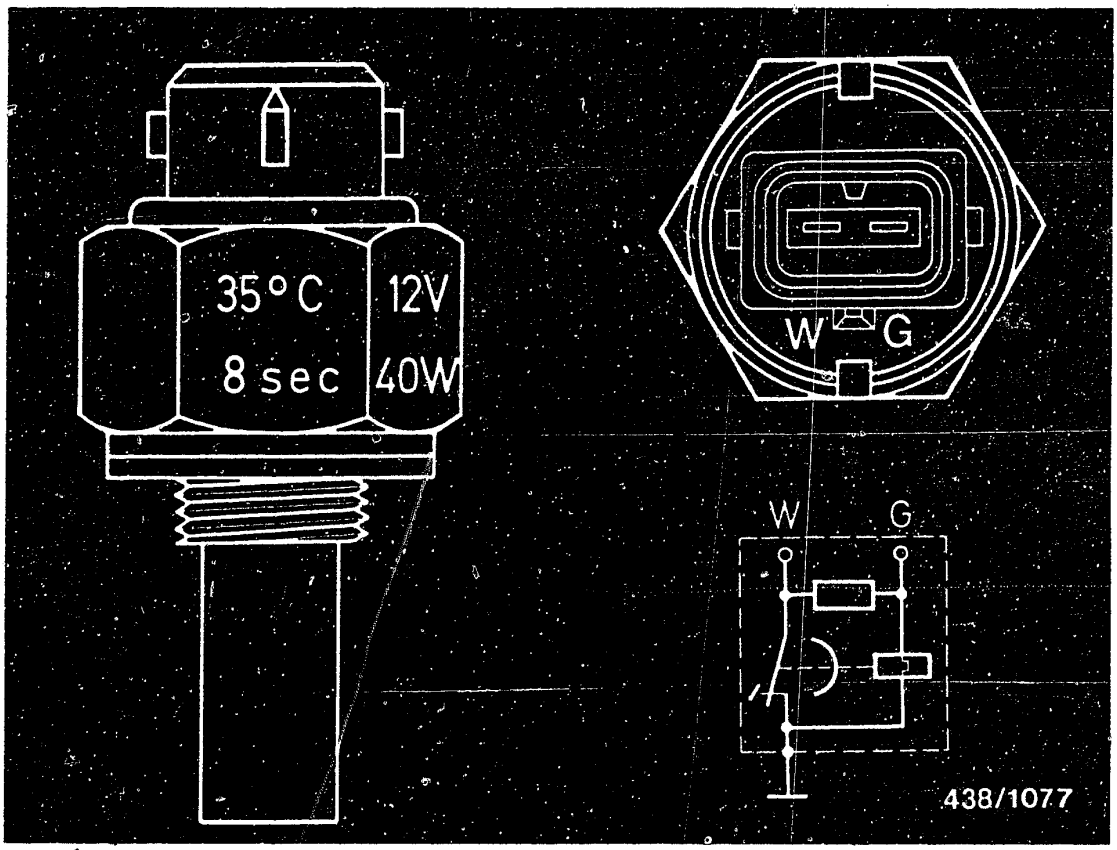


14. CHECKING THE COLD-STARTING SYSTEM

14.1 Thermo-time switch

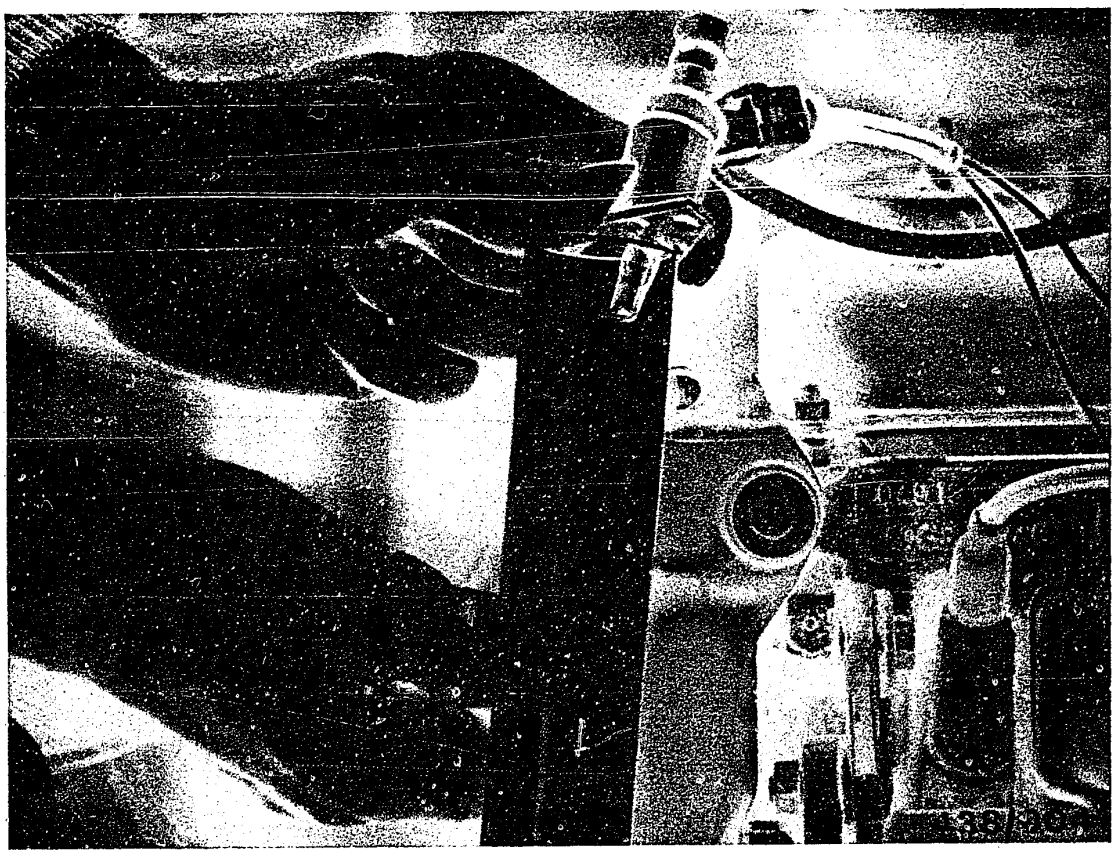
The thermo-time switch (Item 4) is screwed into the fitting in the coolant system.

For testing, remove the thermo-time switch.
Remove the connector.
Catch any escaping coolant in a suitable vessel.



The switching temperature +35°C and the switching time at -20°C of 8 seconds are stamped into the hexagonal section of the thermo-time switch.
The removed thermo-time switch is tested using the ohm-meter in accordance with the specifications given below. The temperatures for the thermo-time switch can easily be obtained with water. Cooling takes place in a freezer chest.

		Resistance measurement (Ω) between		
At a temperature below °C	above °C	Term."G" and "ground" (housing)	Term. "W" and "ground" (housing)	Term. "G" and term. "W"
+30		25...40	0	25...40
	+40	50...80	100...160	50...80



14.2 Start valve:

Remove the start valve. Hose line remains connected. Pull off the plug and connect the start valve directly to ground and to terminal 15 (e.g. at the ignition coil) using connecting cable KDJE 7450/70.

Important note:

During this test, do not let the connecting cable touch B +. Danger of fire due to sparking!

Hold the start valve in a suitable container (e.g. the graduate). Switch on the electric fuel pump by bridging the safety circuit.

Switch on the ignition (max. 30 seconds). The start valve must now open and spray fuel.

CAUTION!
Never deflect (raise) the air-flow sensor plate with the electric fuel pump running since otherwise fuel will be injected. Subsequent operation of the starting motor may lead to serious engine damage.

Switch off the ignition, remove the electric connecting cable and dry the nozzle of the start valve.
The safety circuit remains bridged so that the primary pressure is applied to the start valve.
No droplets of fuel must drip from the nozzle of the start valve during the next minute. Even if shaken and knocked, the start valve must not leak.
Then switch the electric fuel pump off again.
Replace the start valve if it does not open or it it leaks.

If a leaky start valve or a defective thermo-time switch has been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates H 1.

15. Checking the control pressures

15.1 Preliminary remarks:

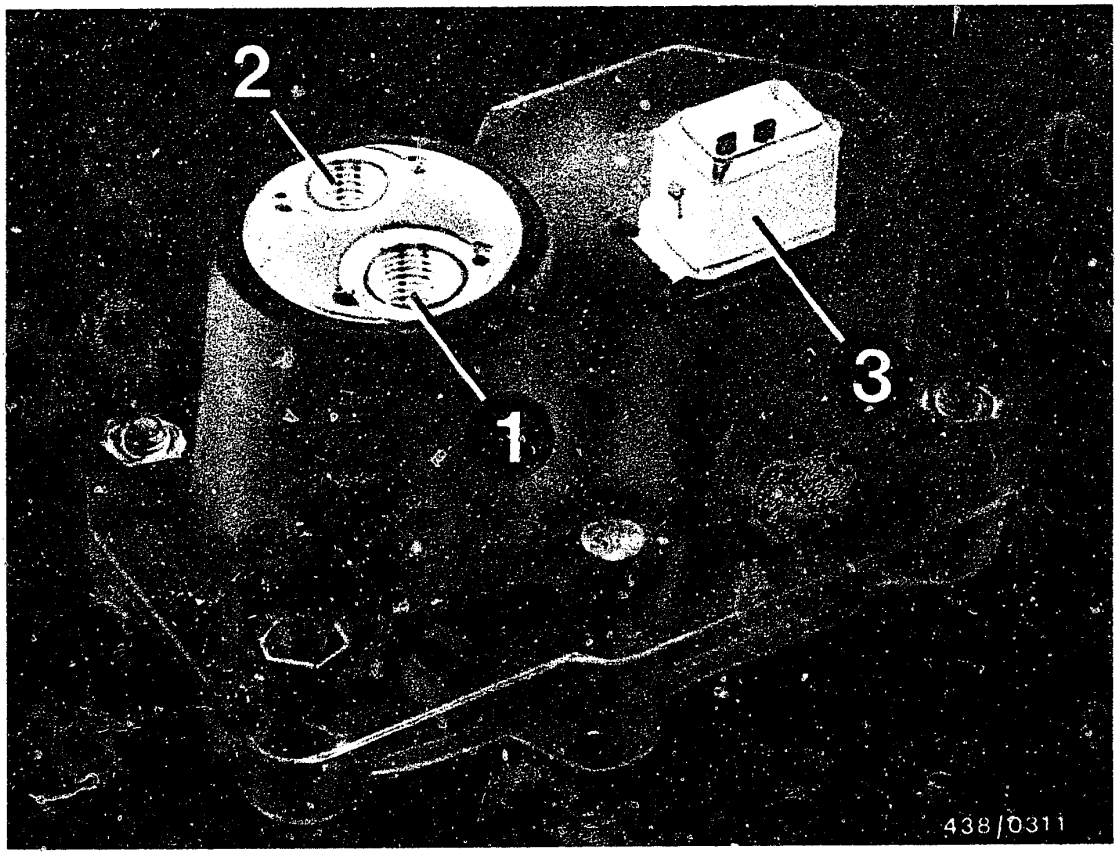
The control pressures tested in the following are basically governed by the warm-up regulator.
If the test results are incorrect, however, this may also be due to faults which have nothing to do with the warm-up regulator.

These possible faults are:

- No voltage or voltage too low at electrical plug. Minimum voltage = 11.5 V.
- Fuel return from the warm-up regulator blocked or constricted.
- Too low or too high a fuel delivery for the control-pressure circuit.

The testing of this control-pressure delivery is described as an additional test step at the beginning of the control pressure tests.
Test specification: 160...240 cm^3/min

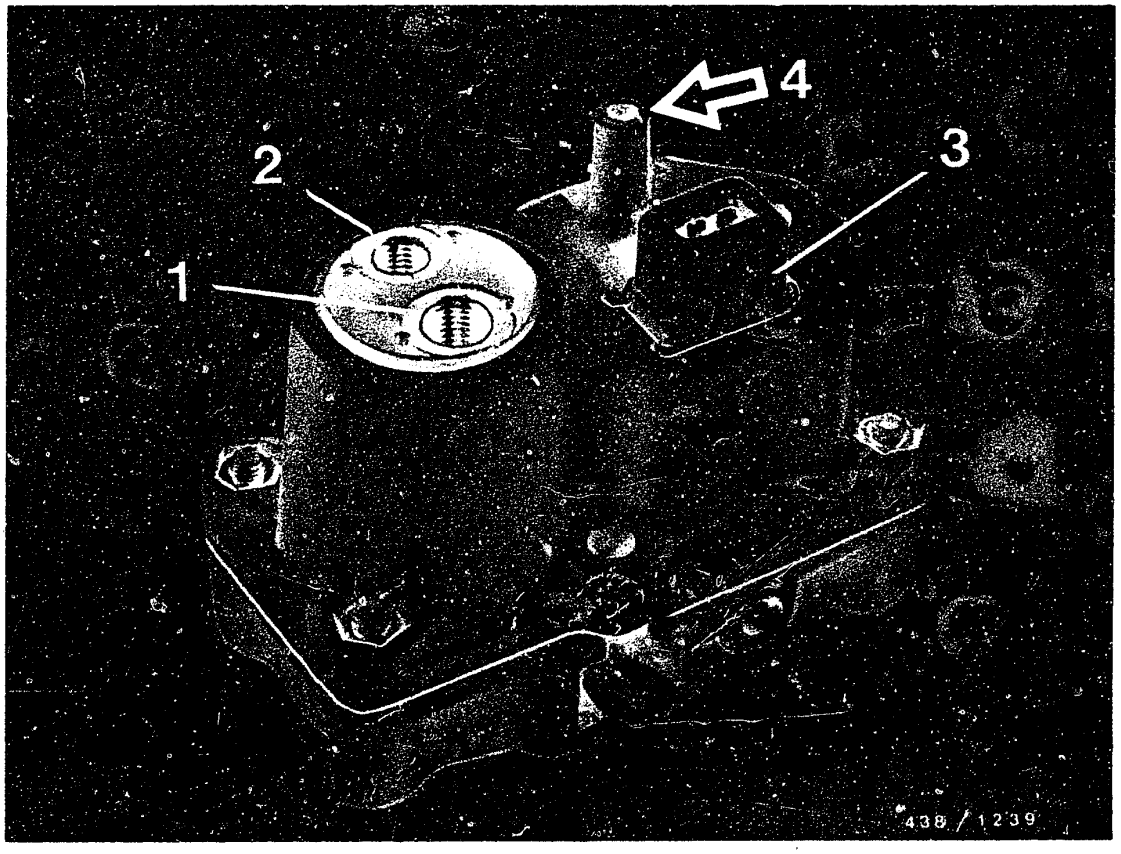
Reference is made to the other possible causes of trouble in the respective test step.



1 = Intake port (M 10 x 1)
2 = Return port (M 8 x 1)
3 = Electrical connection

15.2 Versions of warm-up regulator

- Warm-up regulator 0 438 140 011
  The warm-up regulator corresponds to the standard design, i.e. apart from control pressure "cold" and "warm" no other functions (such as full-load and altitude compensation) are performed.

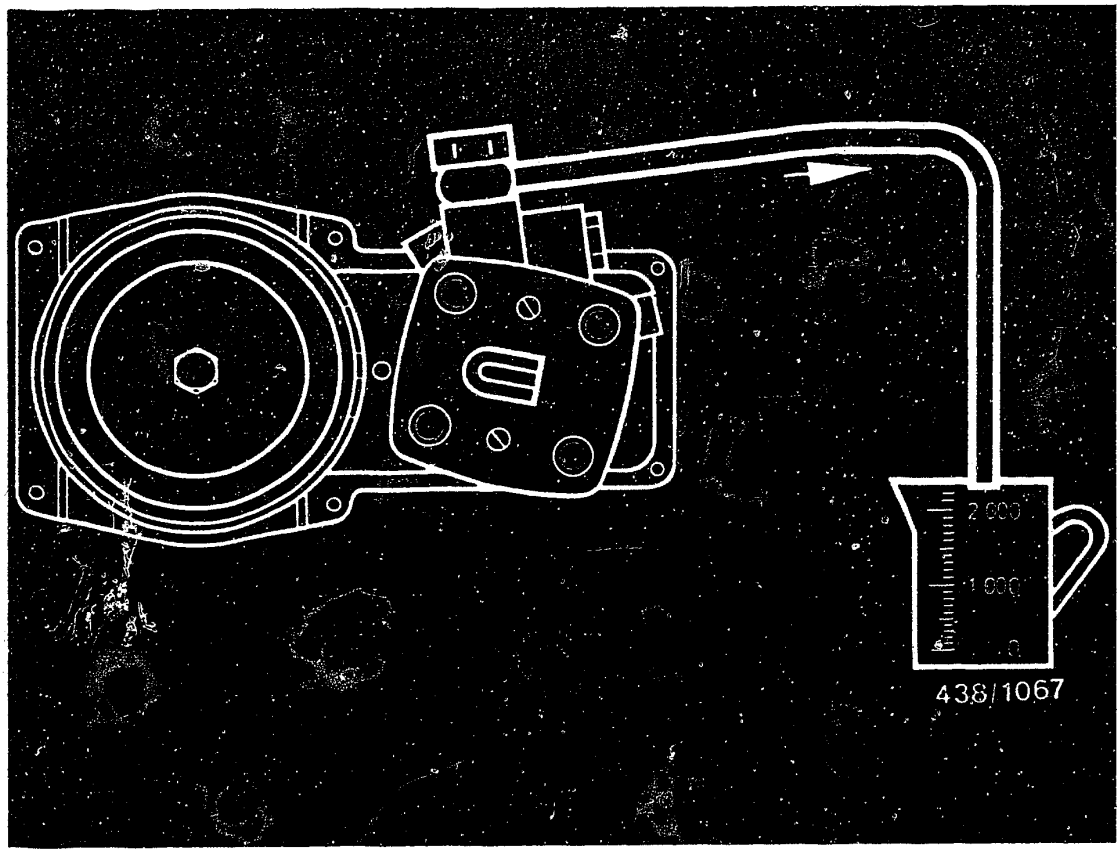


1 = Supply connection (M 10 x 1)
2 = Return connection (M 8 x 1)
3 = Electrical connection
4 = Atmospheric pressure connection

- 0 438 140 026/.. 027

This warm-up regulator is designed for altitude compensation.

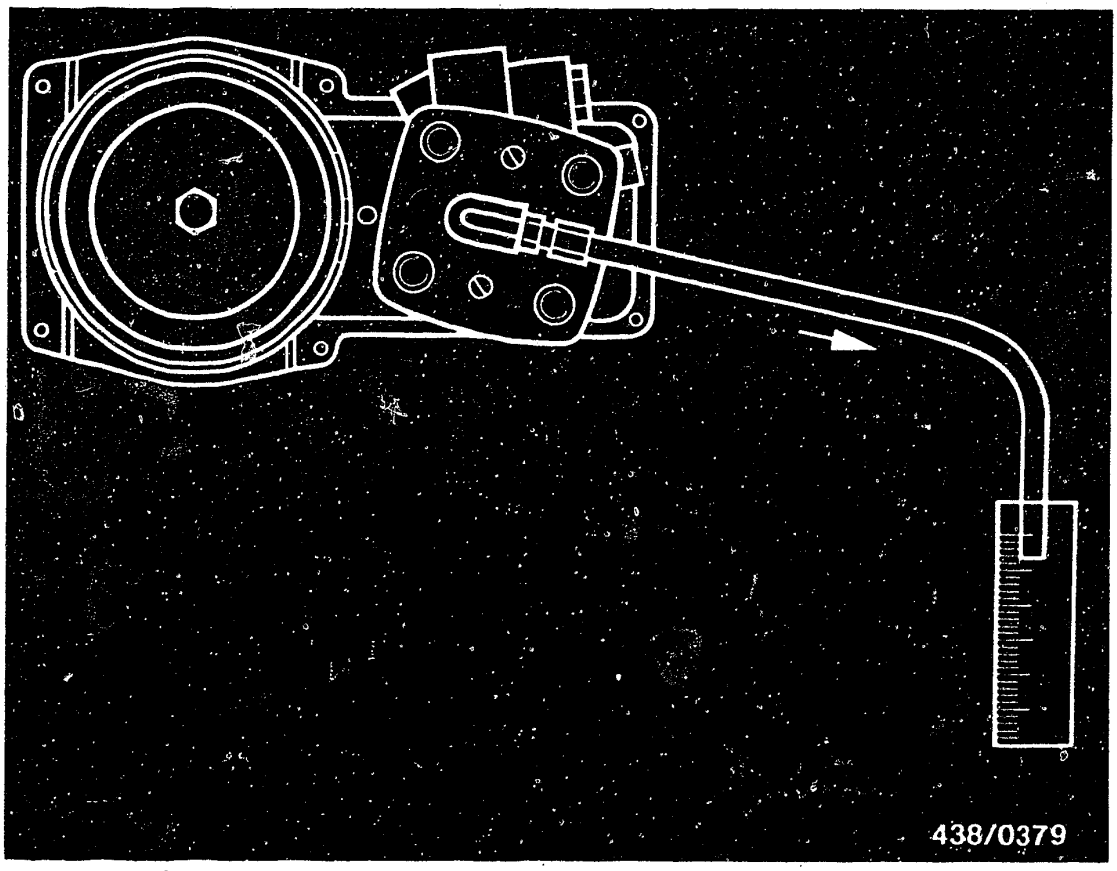
The cold and warm control pressures are additionally influenced by atmospheric pressure which acts on the altitude capsule of the warm-up regulator.
The atmospheric pressure connection (arrow) is located on the top of the regulator housing cover.
The regulator is connected to the engine upstream of the throttle valve.



15.3 Testing the fuel delivery for the control-pressure circuit:

Before testing, make sure that the electric fuel pump is operating correctly.
Test specification: Min. 750 cm^3/30 sec.

As the measuring point use the screw connector in the fuel return line to the fuel tank.



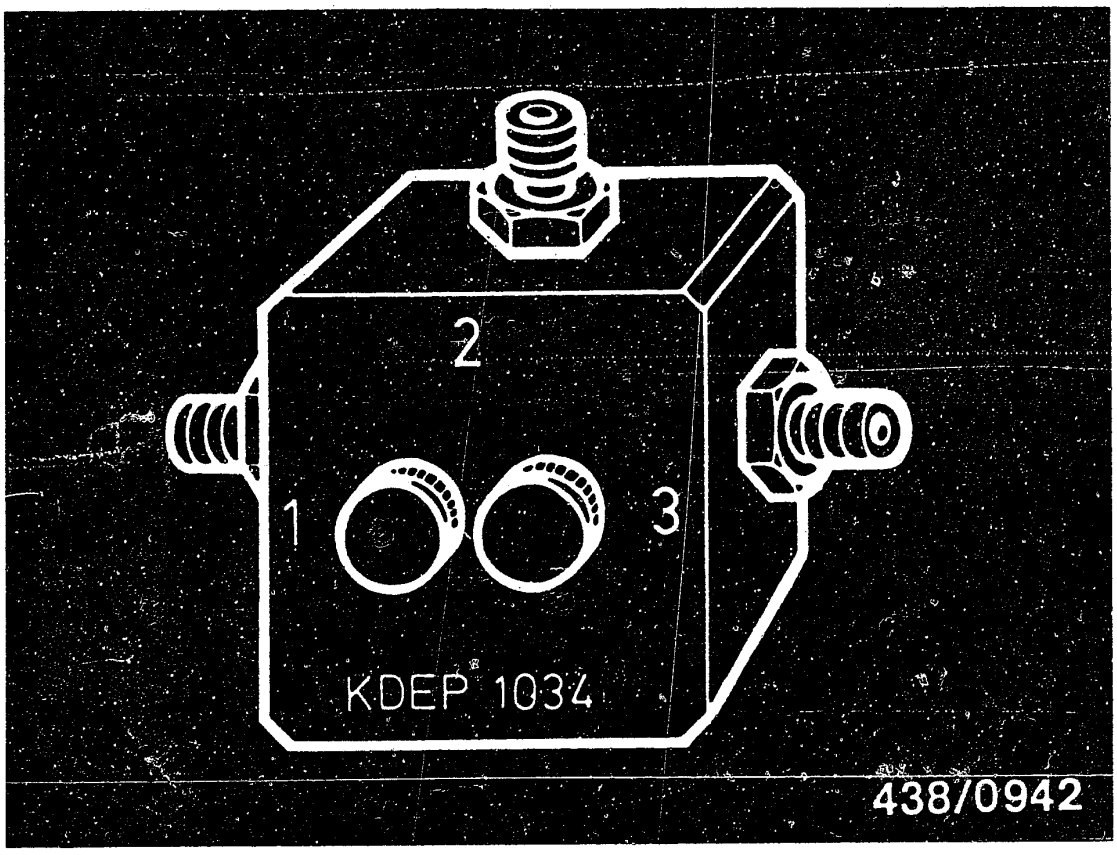
Connect one of the two connecting hoses of the pressure tester KDJE-P 100 (previously KDEP 1034) to the control-pressure port of the fuel distributor (threads M 12 x 1.5) and hold hose in graduate (approx. 0.5 litre capacity).

Switch on the electric fuel pump for 1 minute by bridging the safety circuit.
Measure delivery.

Test specification: 160...240 cm^3/min.

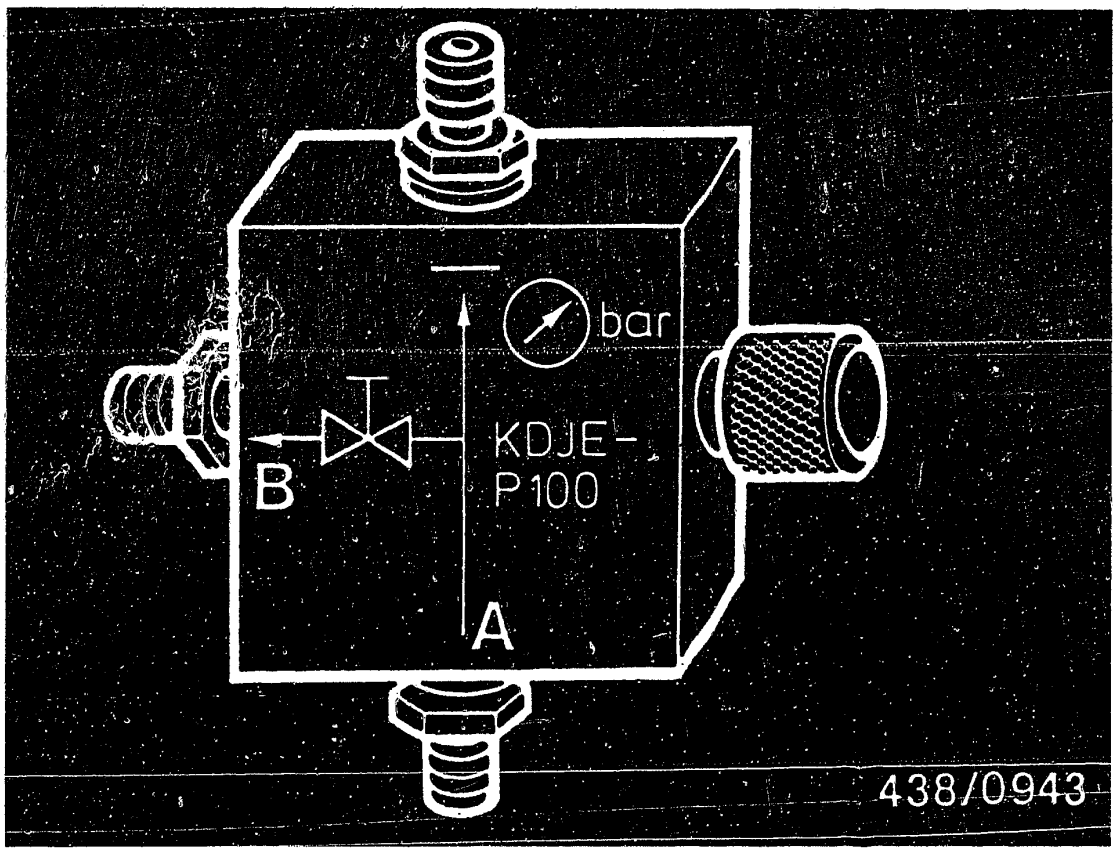
If the measured value is outside tolerance, the fault is in the fuel distributor.

Replace the fuel distributor.



15.4 Mounting the pressure tester KDJE-P 100 (Previously KDEP 1034):

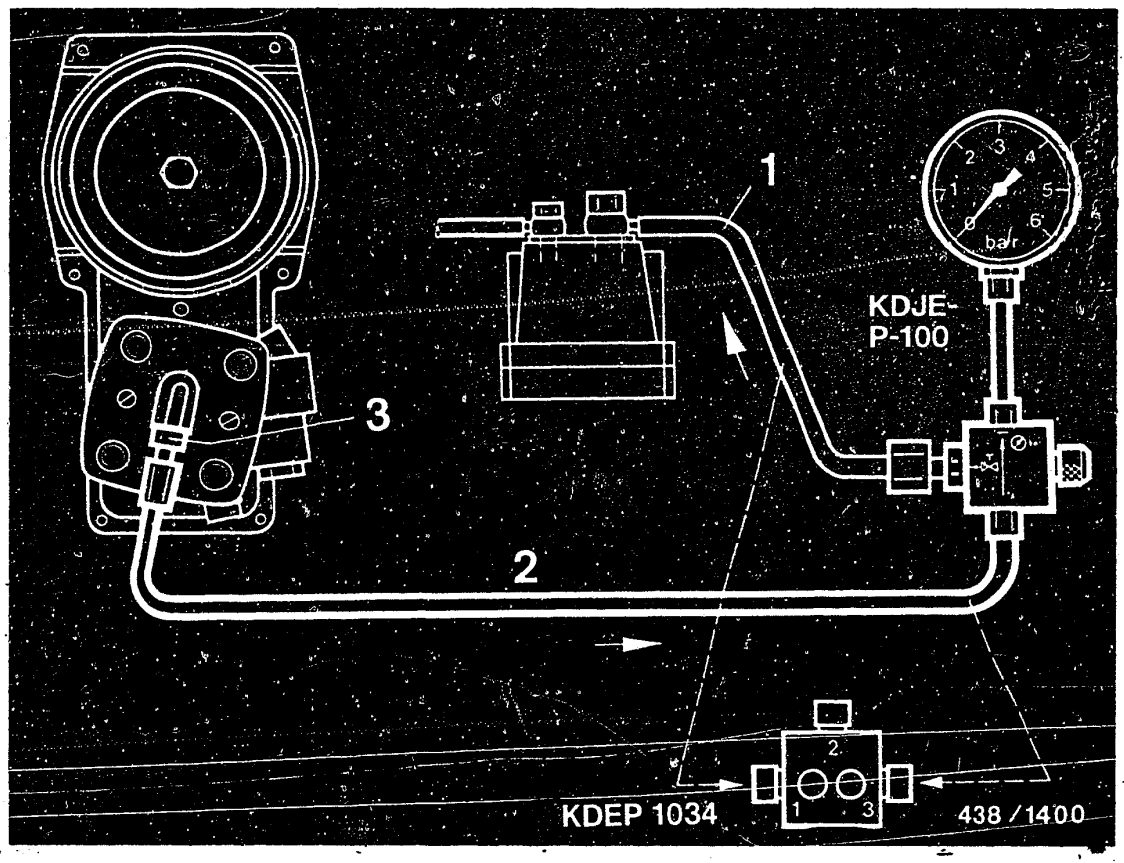
The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate hollow screws. The connections on the directional-control valve are numbered.



Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

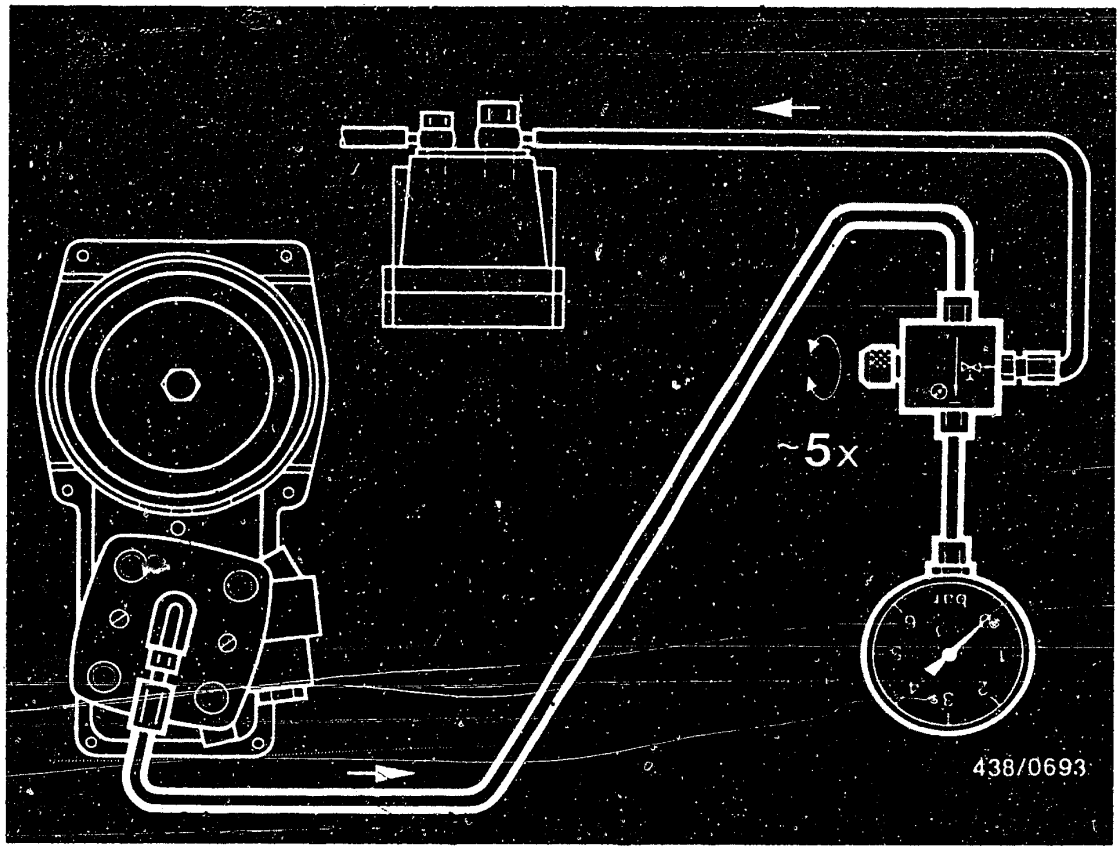
Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Unscrew the control-pressure line (1) on the fuel distributor and connect to outlet fitting B or 1 of the directional-control valve.

Connect the hose line (2) of the pressure tester to the control-pressure connection port (3) of the fuel distributor.



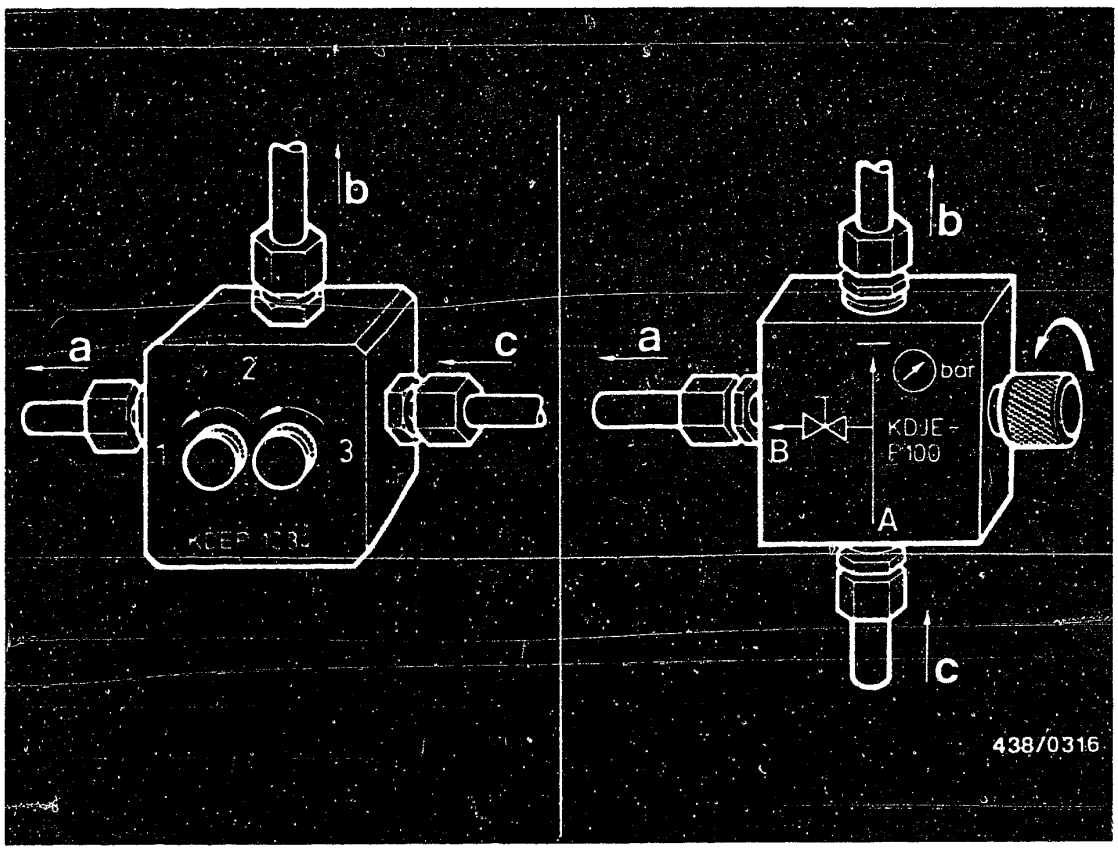
15.5 Bleeding the pressure tester:

Disconnect electric plugs from warm-up regulator and auxiliary-air device.
Let pressure gauge hang down (hose line extended).

Open and close the valve screw of the directional-control valve (valve screw 1 in the case of KDEP 1034) in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).

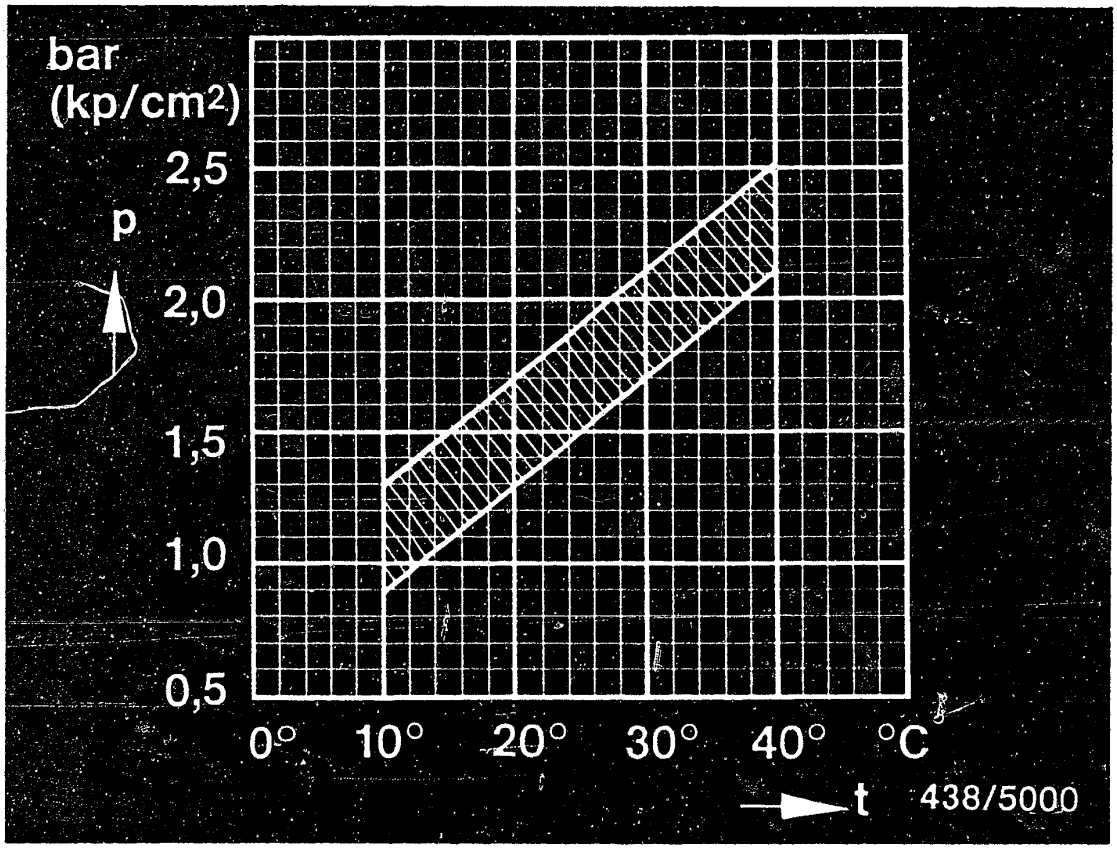
Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

15.6 Testing the "cold" control pressure:

The test is performed with the engine switched off.
The engine must be cold. For this purpose, the engine should have been switched off for several hours, preferably overnight.
Pull off the plug from the warm-up regulator.
Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).
Switch on the electric fuel pump by bridging the electrical safety circuit.
The pressure gauge now indicates the "cold" control pressure.

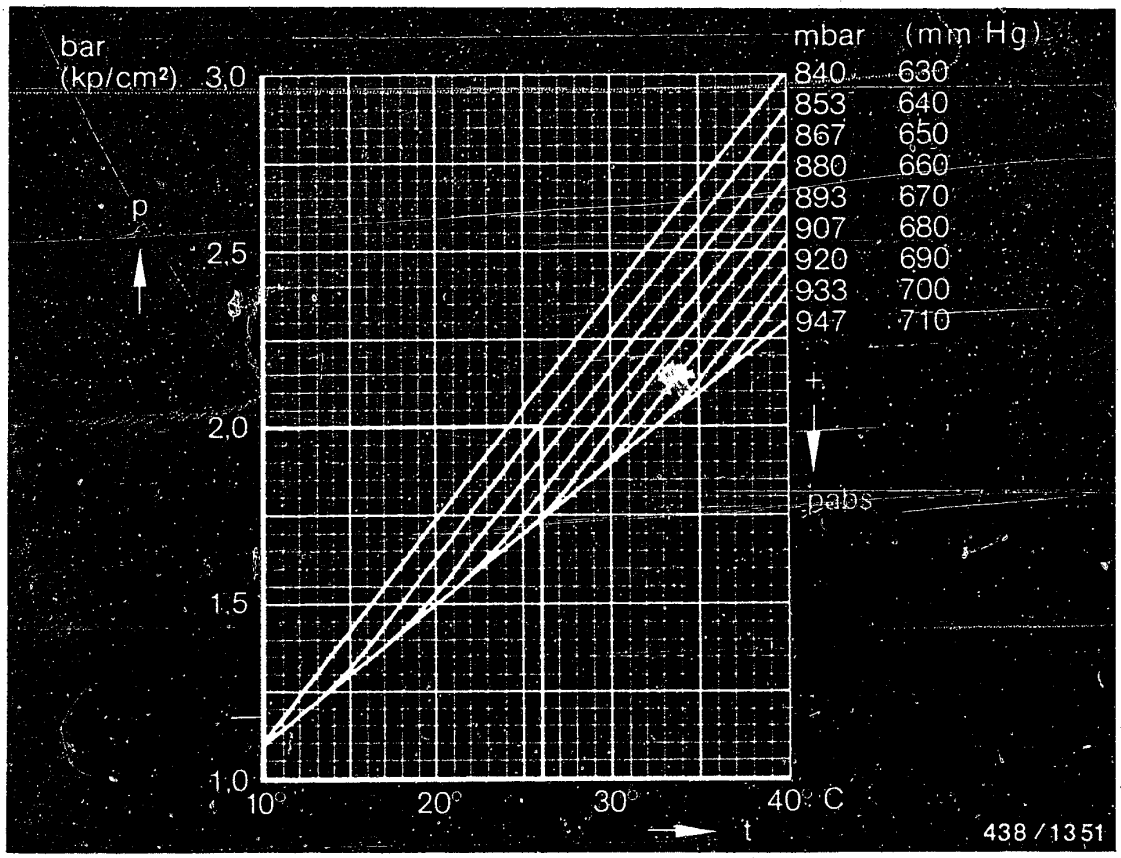


p = Control pressure (bar or kgf/cm² gauge pressure)
t = Ambient temperature (°C)

Warm-up regulator Part No.: 0 438 140 011

Calculate the nominal control pressure in accordance with the ambient temperatures in the graph.

Example: Ambient temperature = 20°C
Nominal control pressure = 1.3... 1,7 bar gauge pressure



p = Control pressure (gauge pressure)
t = Ambient temperature
pabs = Air pressure

- Warm-up regulator part number 0 438 140 026/.. 027
  Version for altitude compensation

Obtain the specified value for control pressure from the diagram to correspond to the ambient temperature and the atmospheric pressure.
The basic curve for the control pressure is subject to a tolerance of ± 0.2 bar.
The altitude curves for the control pressure are subject to a tolerance of ± 0.25 bar.
The basic curve applies for atmospheric pressure greater than 947 mbar (710 mmHg).

Example: Ambient temperature = 26°C
Atmospheric pressure = 853 mbar (640 mm Hg)
Target control pressure = 1,75...2,25 bar gauge pressure

The following are possible causes for deviation of the measured "cold" control pressure from the target value:

- Fuel delivery rate too low or too high for control pressure circuit.
  Check fuel delivery rate.

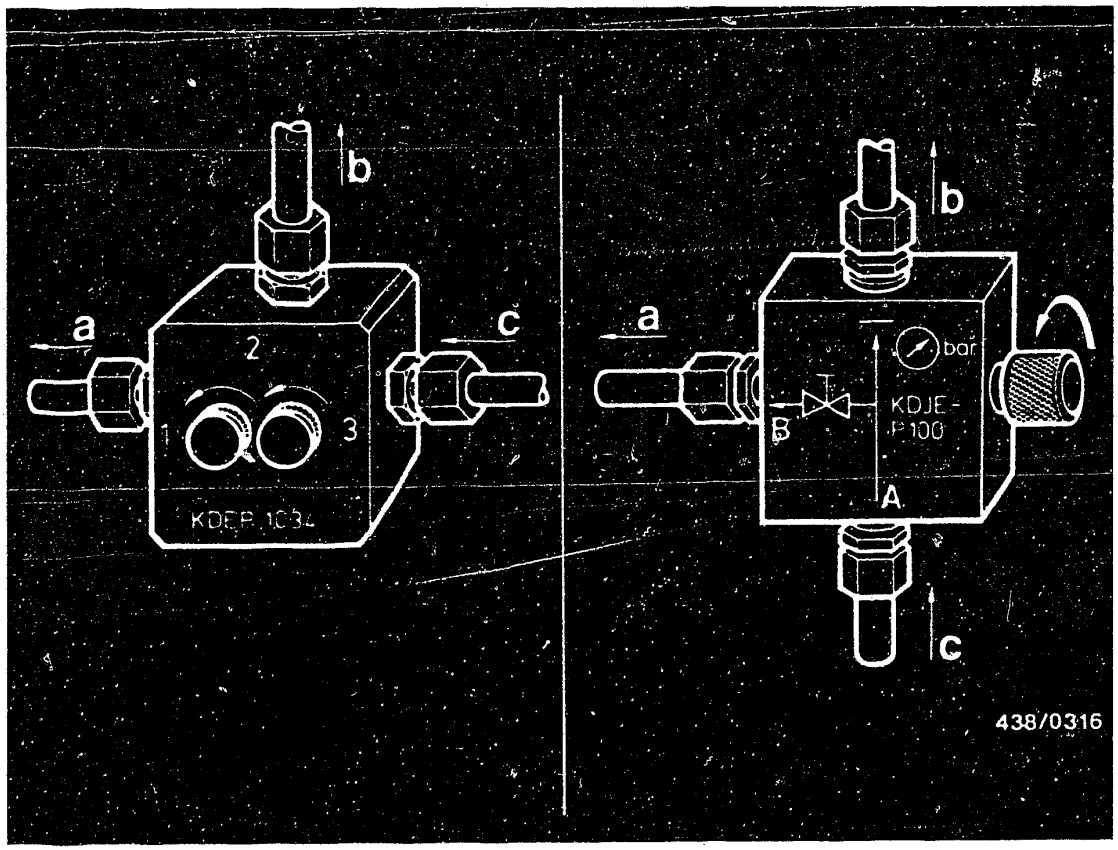
  Test value: 160 ... 240 cm^3/min

- Fuel return (possibly push valve) from warm-up regulator blocked or constricted (if control pressure too high) eliminate constriction.

- Warm-up regulator is defective. Replace warm-up regulator.

If the warm-up regulator was replaced or a fault was found, the idle speed must then be set with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates H 1.



a = to warm-up regulator
b = to pressure gauge
c = from fuel distributor

15.7 Checking the "warm" control pressure

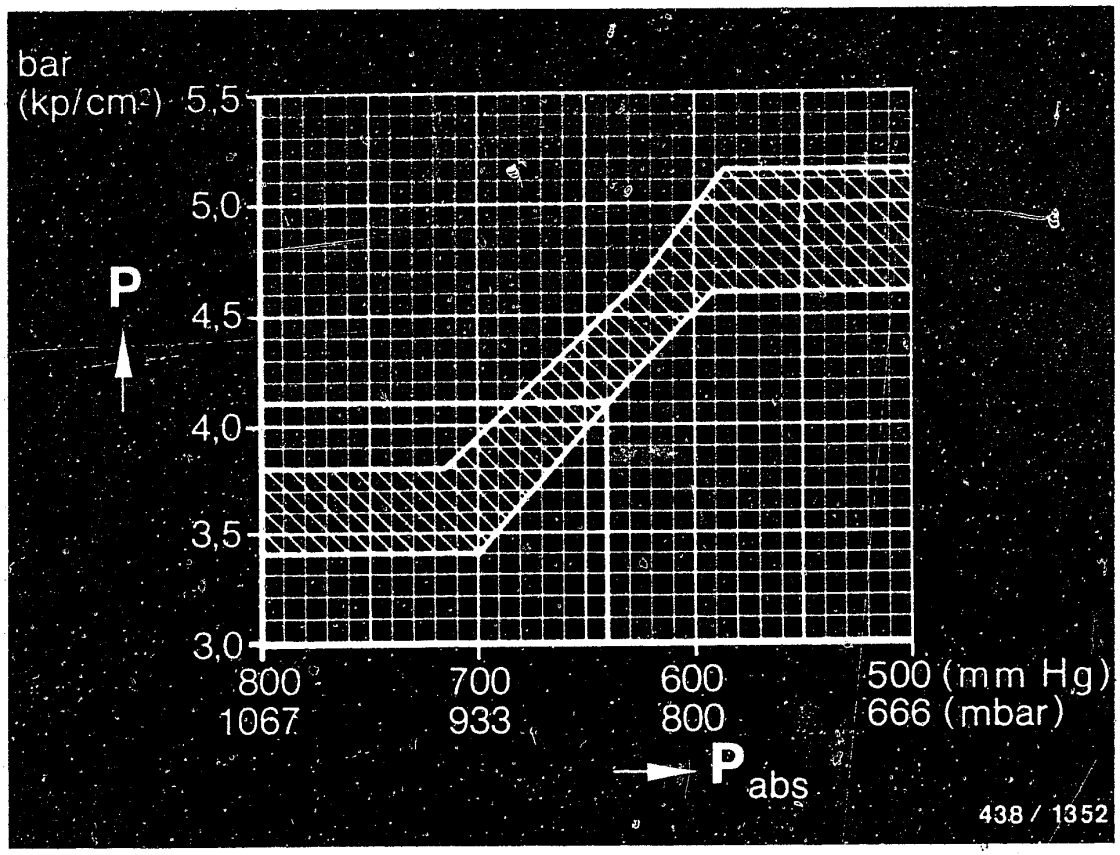
- Warm-up regulator part number: 0 438 140 011 (basic version)
- Warm-up regulator part number: 0 438 140 026/.. 027 (version for altitude correction)
- The test is carried out with the engine switched off.
- The temperature of the engine is not important.
- Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).
- Switch on the electric fuel pump by bridging the electric safety circuit.

- Attach the plug to the warm-up regulator.

Control pressure now rises (the warm-up regulator in the process of shutting off) until the "warm" control pressure is reached.

Warm-up regulator part number: 0 438 140 011

"Warm" control pressure test specification: 3.4 ... 3.8 bar gauge pressure (3.5 ... 3.9 kp/cm² gauge pressure)



p = Control pressure (gauge pressure)
pabs = Air pressure

- Warm-up regulator 0 438 140 026/.. 027
  Version with altitude correction

  Measure the control pressure immediately after the warm-up regulator has settled.

  Determine the target control pressure in accordance with the atmospheric pressure from the above graph.

Example: Atmospheric pressure = 850 mbar (638 mmHg)
Control pressure should be = 4.1...4.5 bar (gauge pressure)
(4.2...4.6 kp/cm² gauge pressure)

The following are possible causes for deviation of the measured "warm" control pressure from the target value:

If the control pressure is too high:

- Fuel delivery rate is too high for control pressure circuit.
  Check fuel delivery rate.
  Test value: 160...240 cm^3/min

- Fuel return line from warm-up regulator is blocked or restricted. Remove restriction.

- Warm-up regulator is hydraulically defective.
  Replace warm-up regulator.

If the control pressure is too low:

- Open circuit in electrical system.
  Repair open circuit. Make sure the connector makes good contact.

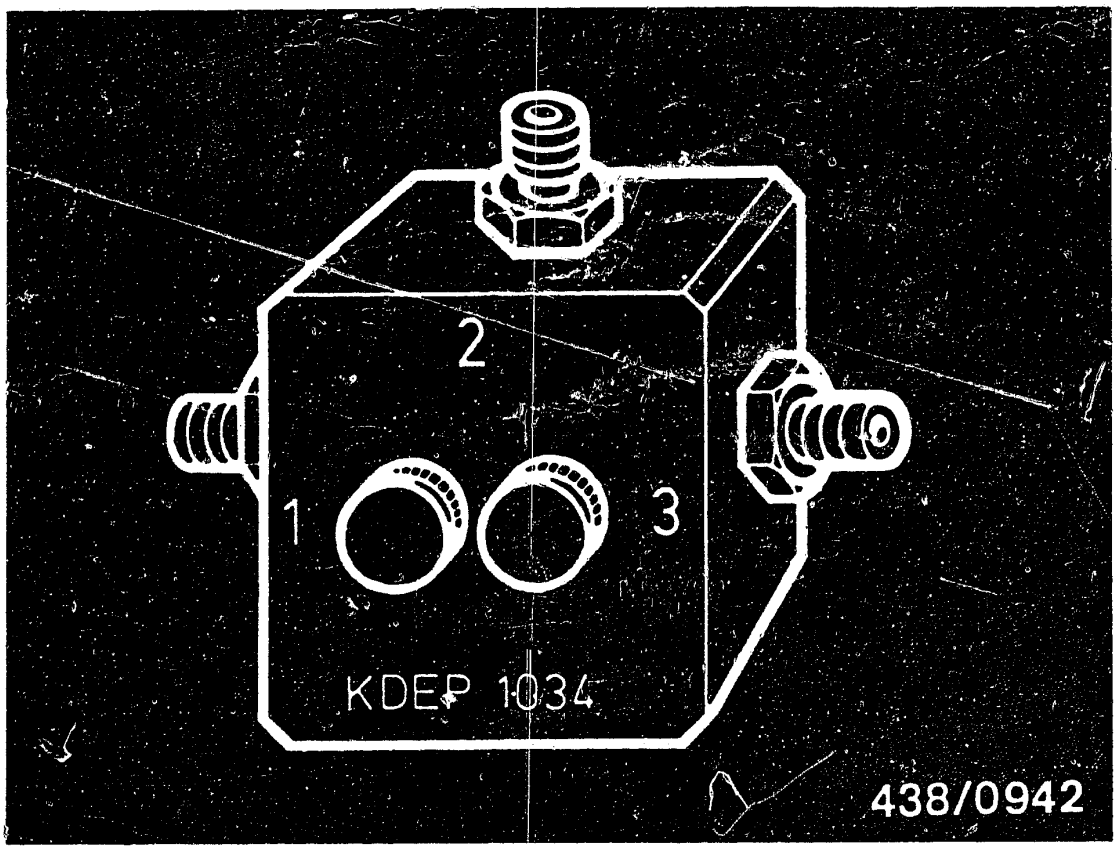
- Battery voltage too low -- voltage drop.
  Remedy voltage drop. Minimum voltage at connector: 11.5 V.
  Repeat the test procedure with the engine running if necessary, in order to achieve the normal generator voltage under driving conditions of approx. 14 V.

- Fuel delivery rate is too low for control pressure circuit.
  Check fuel delivery rate.
  Test value: 160 ... 240 cm^3/min

- Warm-up regulator is defective. Open heating coil.
  Hydraulically defective. Replace warm-up regulator.

If the warm-up regulator was replaced or a fault was found, the idle speed must then be set with the engine at operating temperature.

The idle adjustment procedure is explained at coordinates H 1.

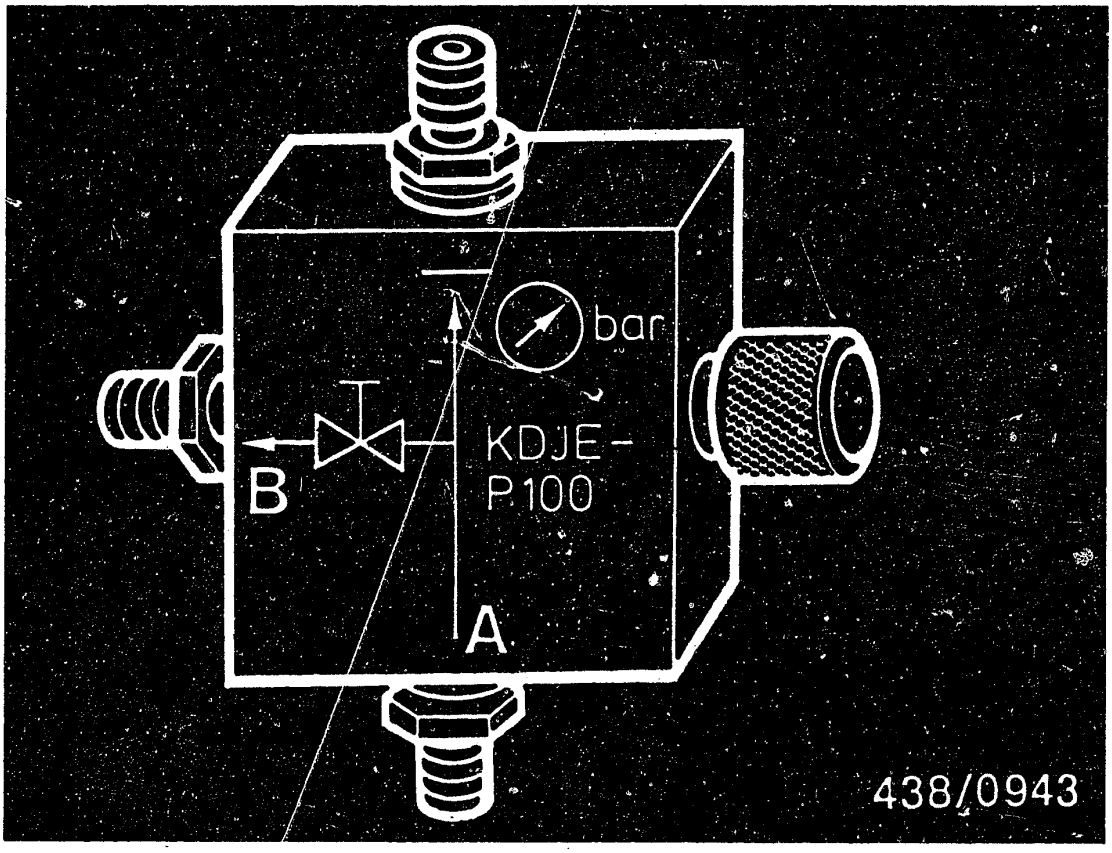


16. Checking and setting the primary pressure

16.1 Attaching pressure tester KDJE-P 100 (formerly KDEP 1034):

Pressure tester KDEP 1034 comprises a three-way valve with two separate valve screws.

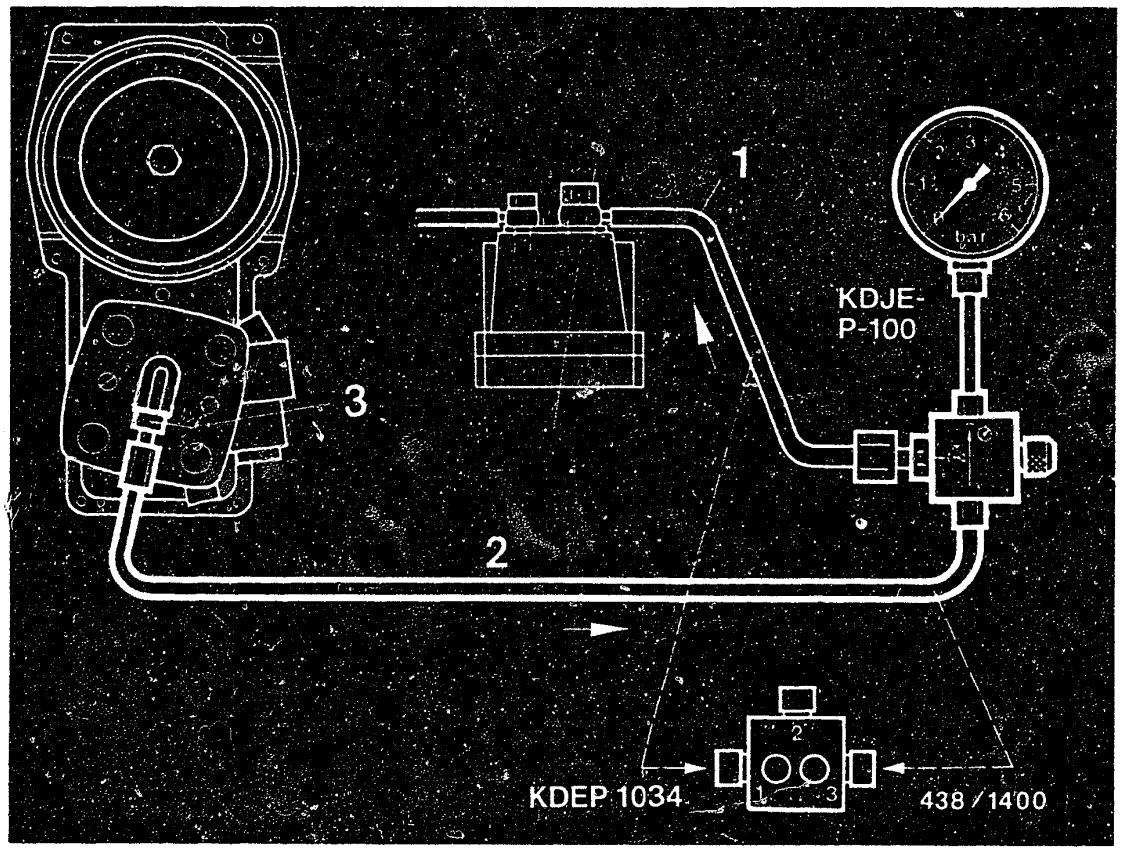
The ports of the directional control valve are numbered.



Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

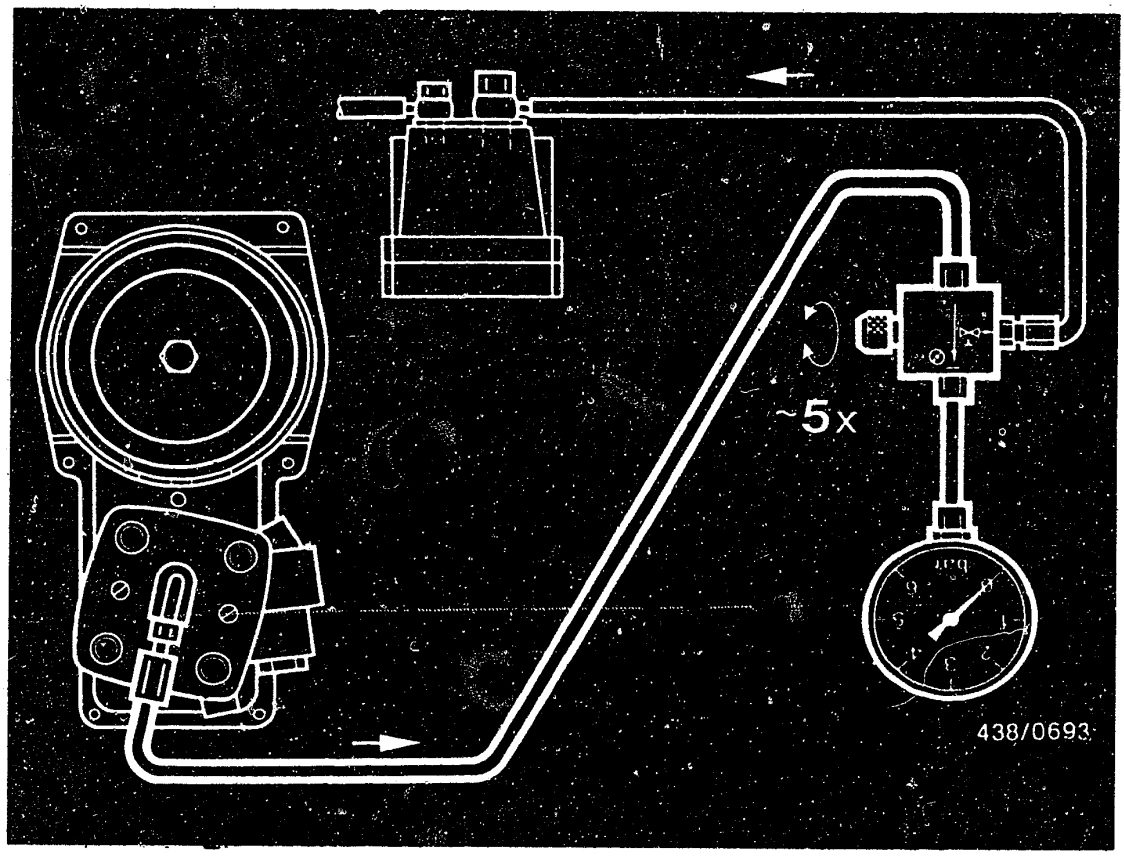
Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Unscrew the control-pressure line (1) on the fuel distributor and connect to outlet fitting B or 1 of the directional-control valve.

Connect the hose line (2) of the pressure tester to the control-pressure connection port (3) of the fuel distributor.



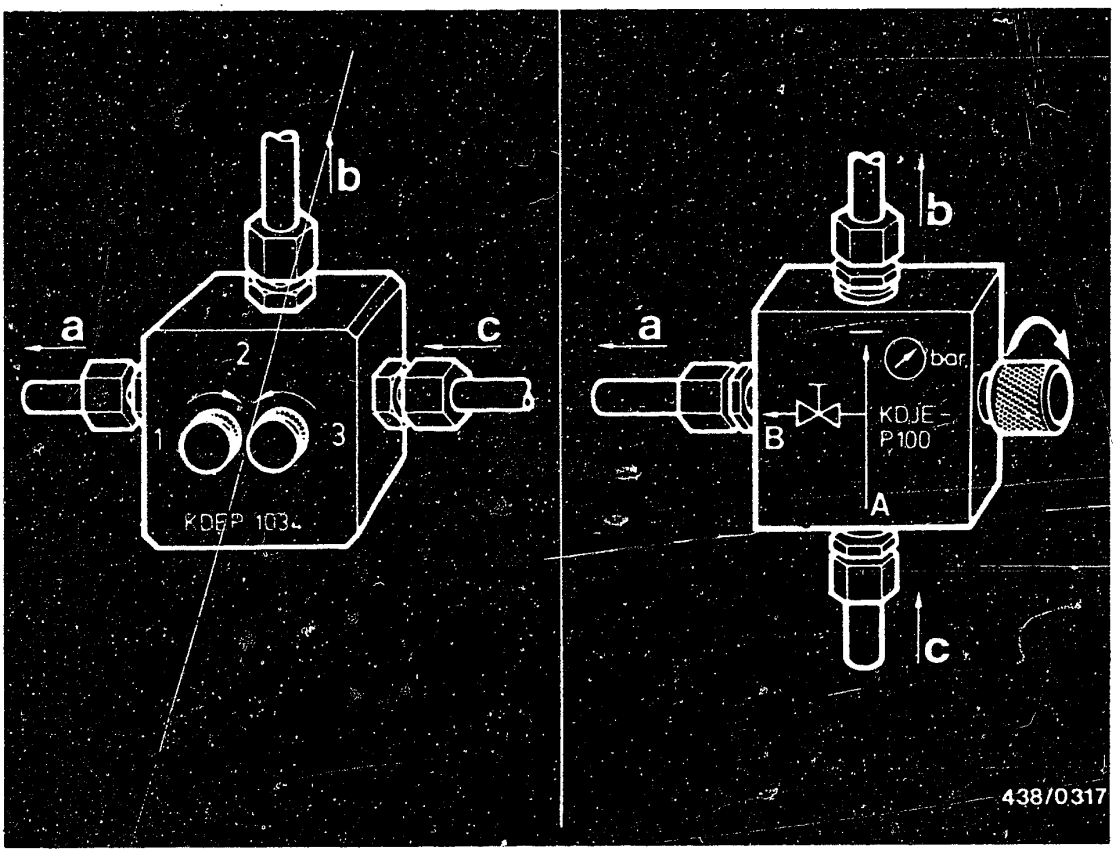
16.2 Bleeding the pressure tester:

Disconnect electric plugs from warm-up regulator and auxiliary-air device.
Let pressure gauge hang down (hose line extended).

Open and close the valve screw of the directional-control valve (valve screw 1 in the case of KDEP 1034) in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).

Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

16.3 Testing the primary pressure:

The test is performed with the engine switched off. The temperature of the engine is not important. Close the valve screw of directional-control valve KDJE-P 100.
In the case of KDEP 1034, close valve screw 1, open valve screw 3.

Switch on the electric fuel pump by bridging the electrical safety circuit.
The pressure gauge now indicates the primary pressure.

Fuel distributor part number	Primary pressure test specification (gauge pressure)
0 438 100 116	4.7...5.4 bar (4.8...5.5 kp/cm²)

Possible causes for too low a primary pressure:

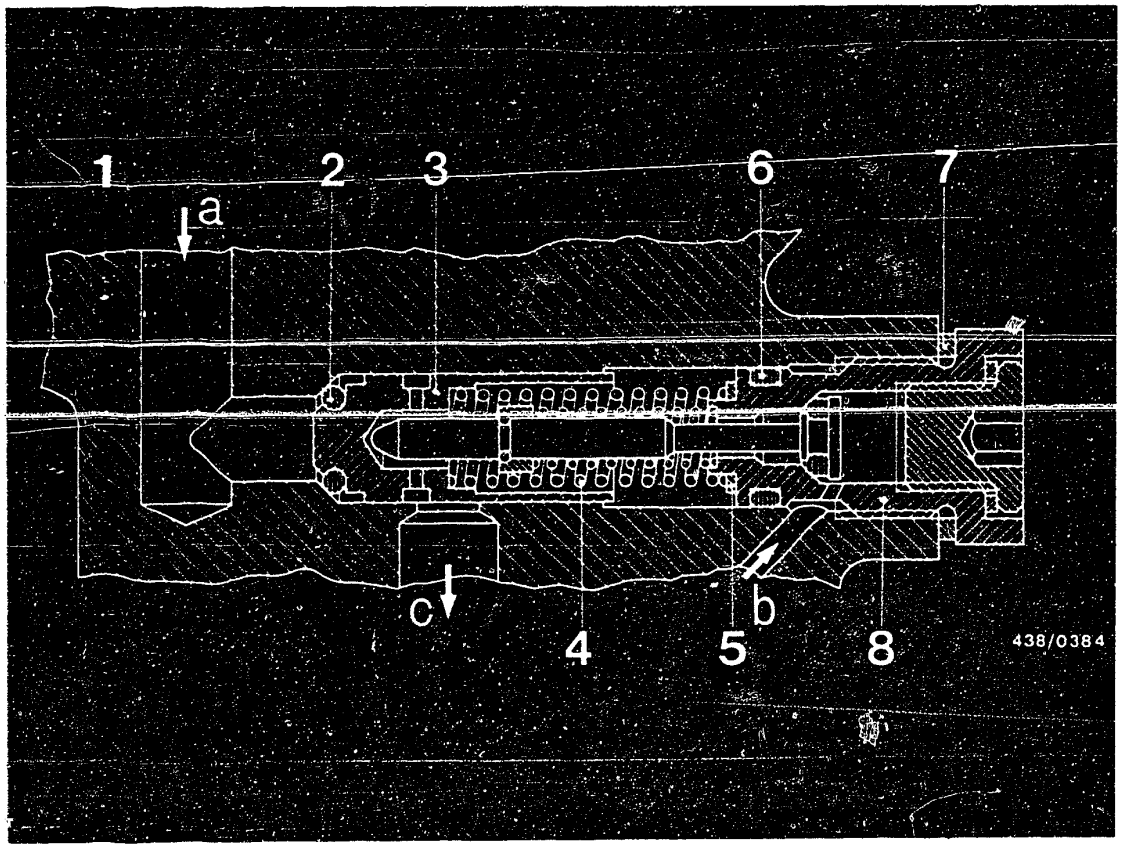
- Fuel supply faulty.
  (Delivery of electric fuel pump too low).

- Primary pressure set incorrectly.
  A precondition for readjustment of the primary pressure is always that the fuel supply is in order.
  Measure the fuel delivery.
  Test specification: 750 cm³/30 s.

Possible causes for too high a primary pressure:

- A restriction in the return line leading to the fuel tank.

- Primary-pressure regulator set incorrectly.
  For this reason, before readjusting too high a primary pressure, always first check the condition of the return line leading to the fuel tank.

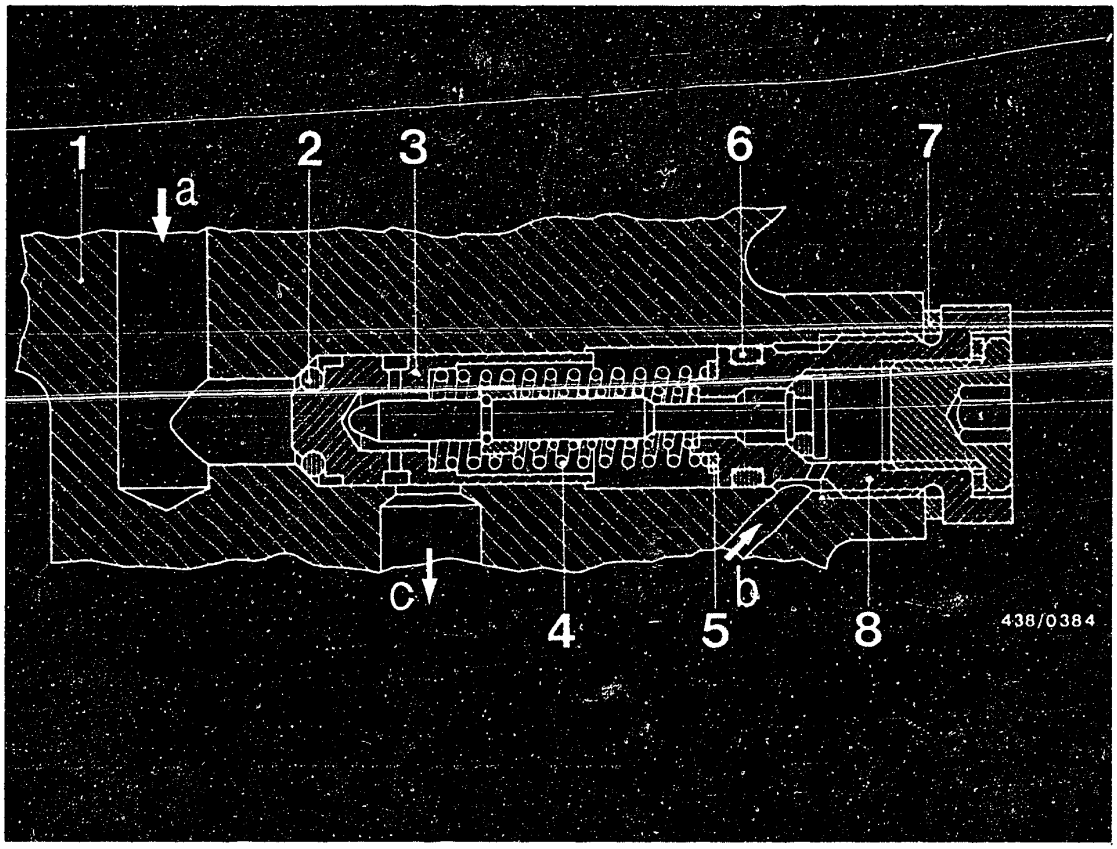


a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

The diagram shows a fuel distributor with push valve

16.4 Adjusting the primary pressure

Fuel distributor part number	Primary pressure setting values (gauge pressure)
0 438 100 116	4.9...5.1 bar (5.0...5.2 kp/cm²)



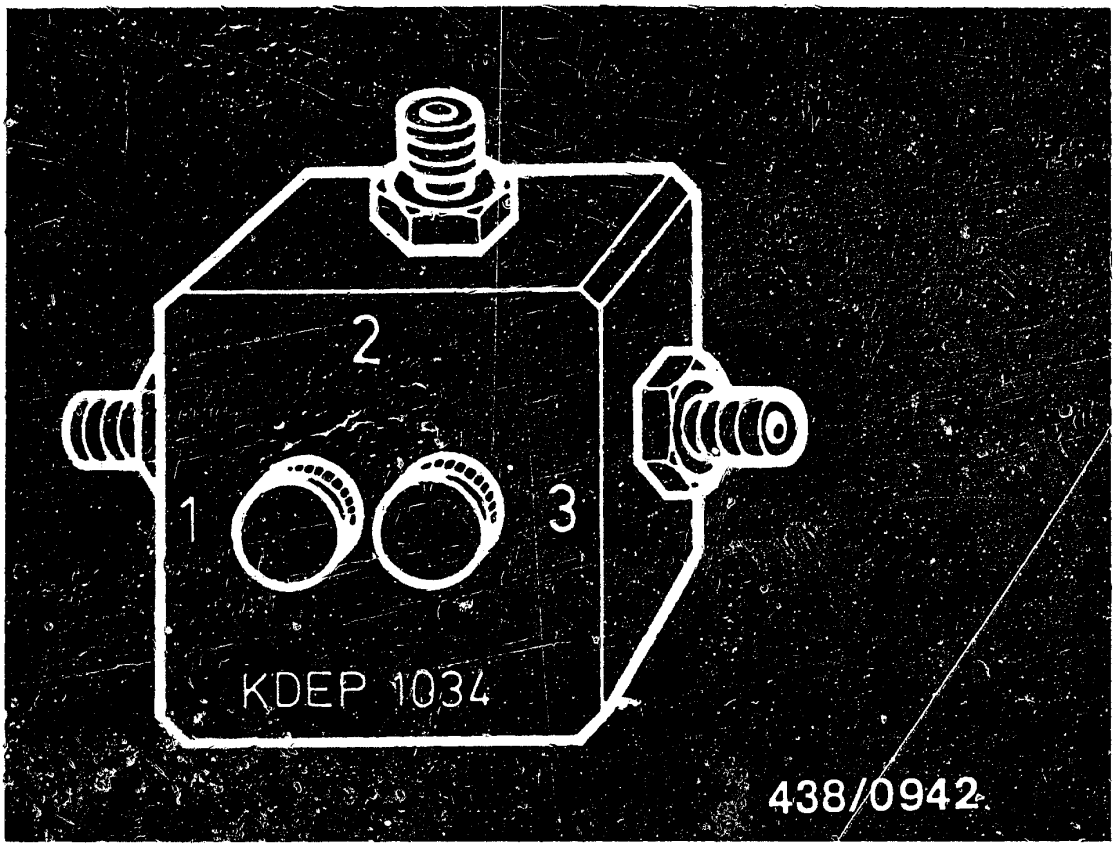
The primary pressure is reset by replacing the shims (5).

N o t e :

An increase of 0.1 mm in shim thickness increases the pressure by approx. 0.15 bar, and vice versa.

To reset the primary pressure, unscrew plug (8) including push valve. After the pressure has been reset, replace the screw plug using a new flat seal (7) and O-ring (6).

Do not lose the control plunger (3) of the primary pressure regulator. It has been matched at the factory to the fuel distributor housing, and is the only part of the primary pressure regulator which c a n n o t be replaced.

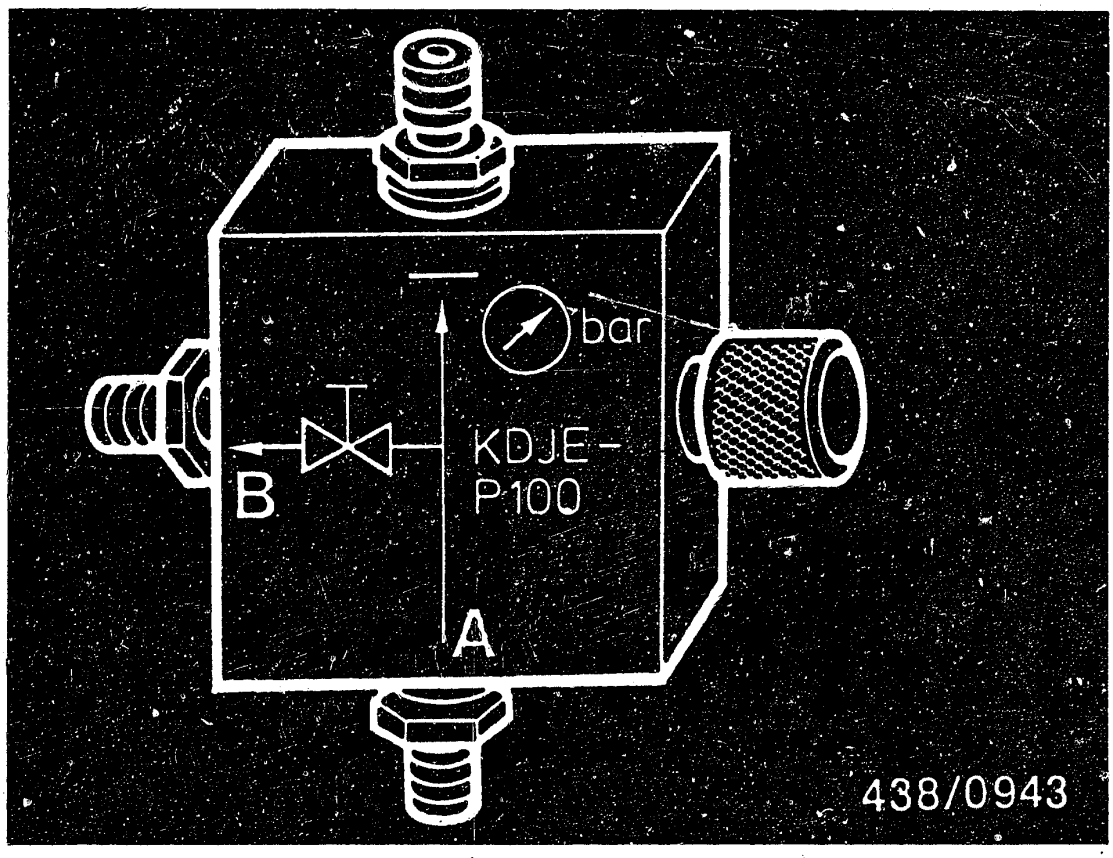


17. Checking entire fuel system for internal leak-tightness

17.1 Attaching pressure tester KDJE-P 100 (formerly KDEP 1034):

Pressure tester KDEP 1034 comprises a three-way valve with two separate valve screws.

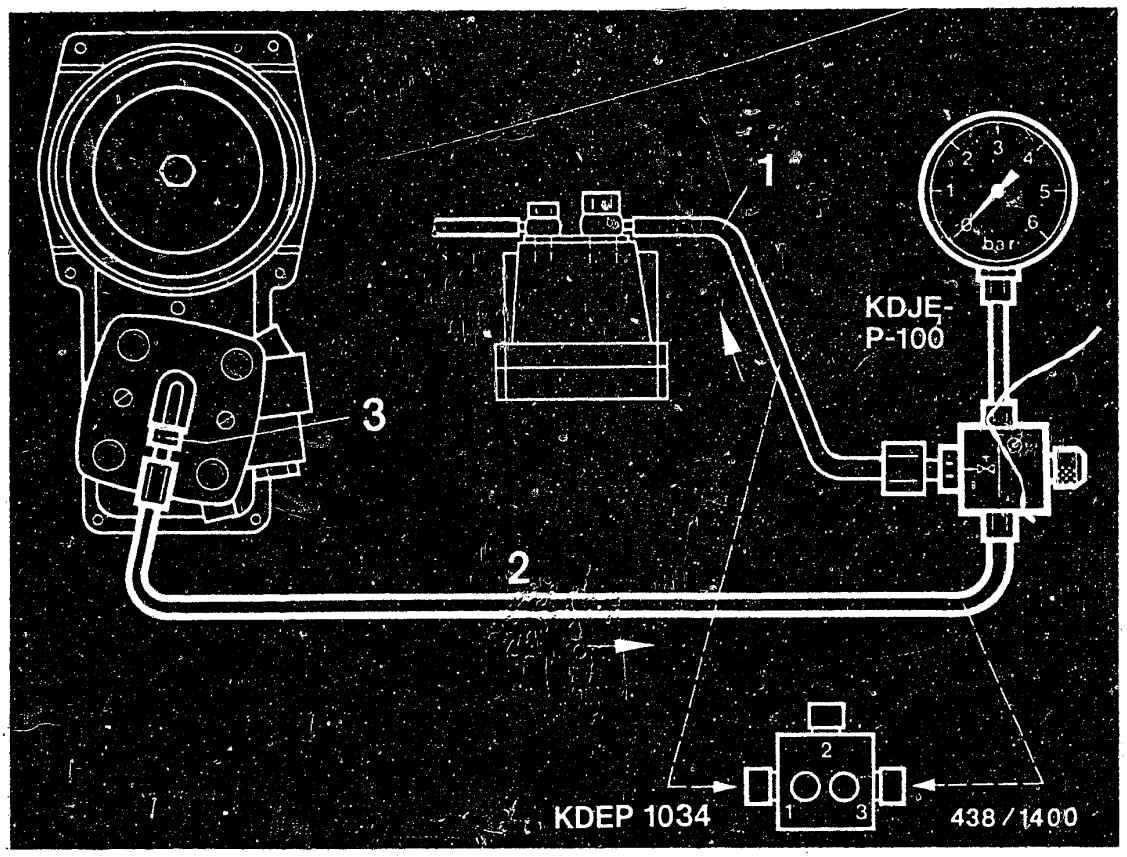
The ports of the directional control valve are numbered.



Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

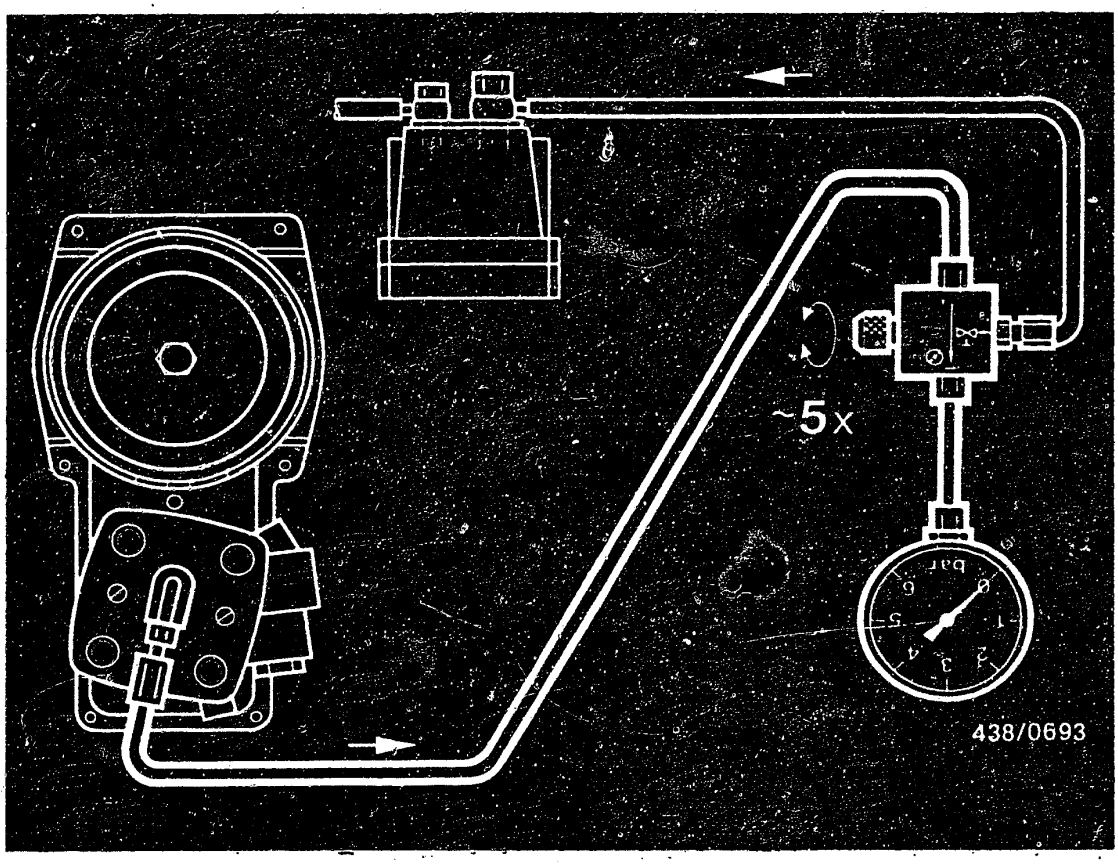
Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Unscrew the control-pressure line (1) on the fuel distributor and connect to outlet fitting B or 1 of the directional-control valve.

Connect the hose line (2) of the pressure tester to the control-pressure connection port (3) of the fuel distributor.



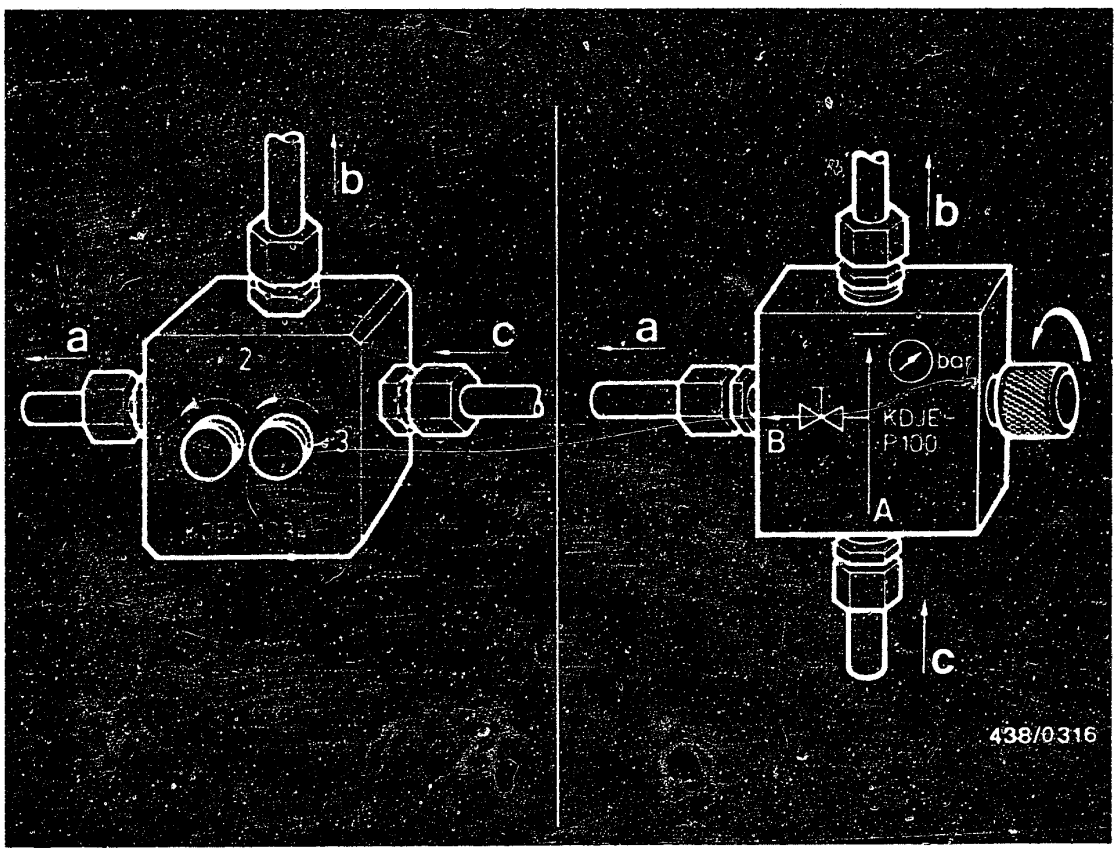
17.2 Bleeding the pressure tester

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended).

Switch on the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional-control valve in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood). Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

17.3 Leak test

The test is performed with the engine switched off. Make the test with a warm engine but not immediately after the engine has been operated at a high temperature.

Open the valve screw of the directional-control valve (both valves in the case of KDEP 1034).

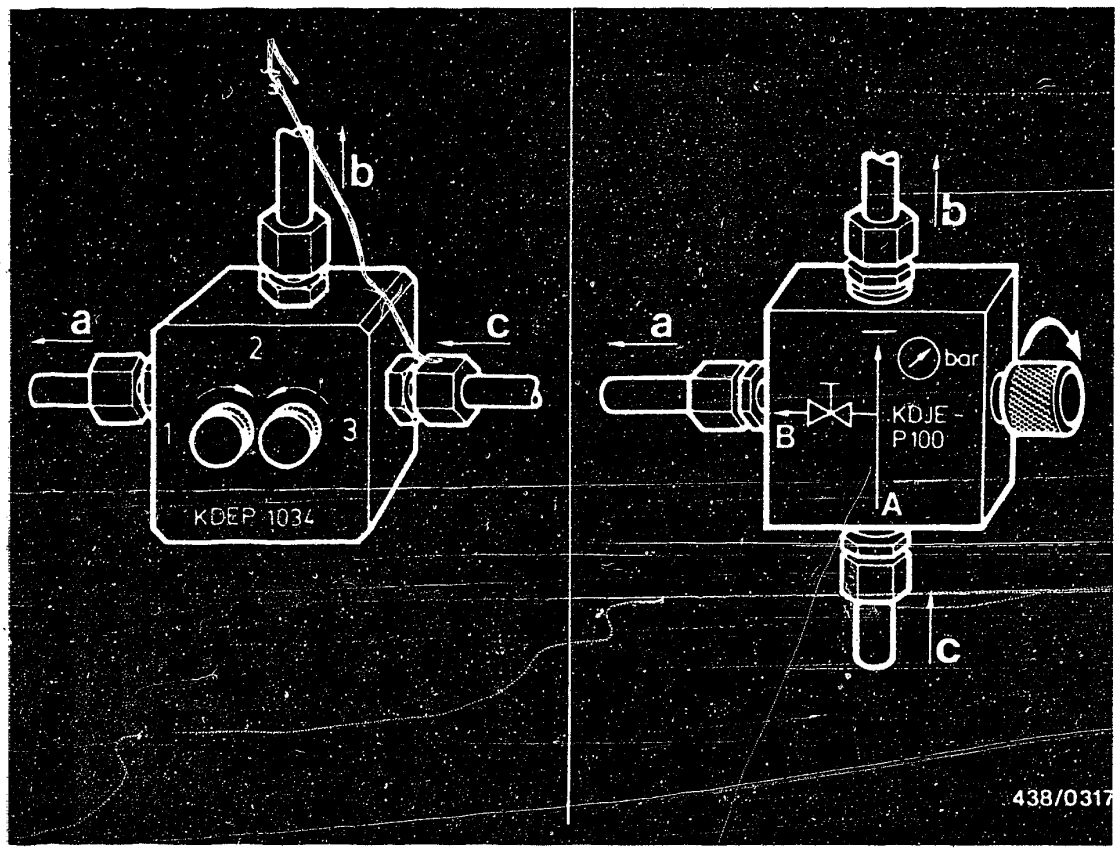
Switch on the electric fuel pump by bridging the electrical safety circuit until the warm-up regulator has ceased to operate ("warm" control pressure).

Switch the electric fuel pump off again and observe the drop in pressure on the pressure gauge.

Test specifications for leak test*

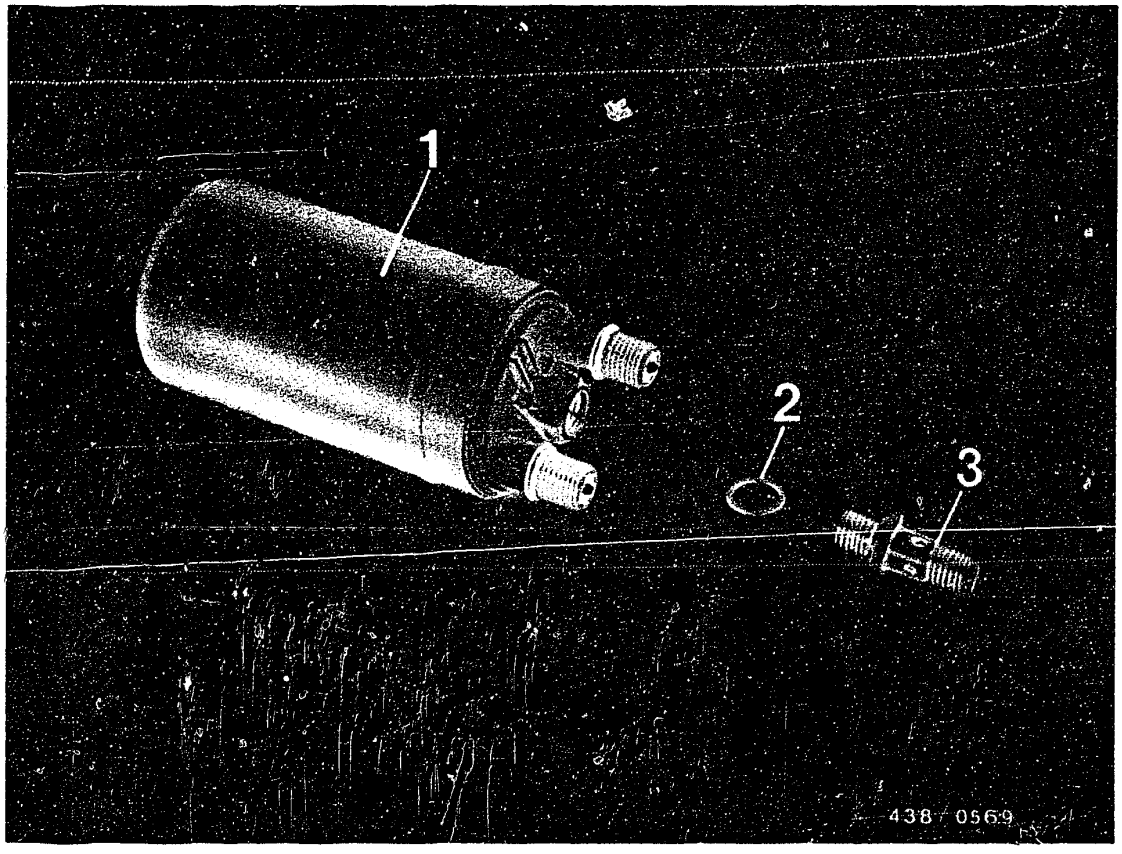
	For fuel accumulator part number 0 438 170 027/0 up to FD 931	438 170 028 as of FD 932
		0 438 170 040/041
	Identified by blue dot	
Minimum pressure after 10 minutes:	2.2 bar (2.3 kp/cm²)	2.5 bar (2.6 kp/cm²)
after 20 minutes:	2.0 bar (2.1 kp/cm²)	2.4 bar (2.5 kp/cm²)

*Pressures are given in bar (kp/cm²) gauge pressure.



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

If the pressure drops too quickly, repeat the test with the control-pressure circuit disconnected.
Position of the valve screws:
Close the valve screw of the directional-control valve KDJE-P 100.
In the case of KDEP 1034, close valve screw 1, open valve screw 2.
If the same result is found, the leak is in the primary-pressure circuit.
If the test results are correct during the second test, the leak is in the control-pressure circuit.



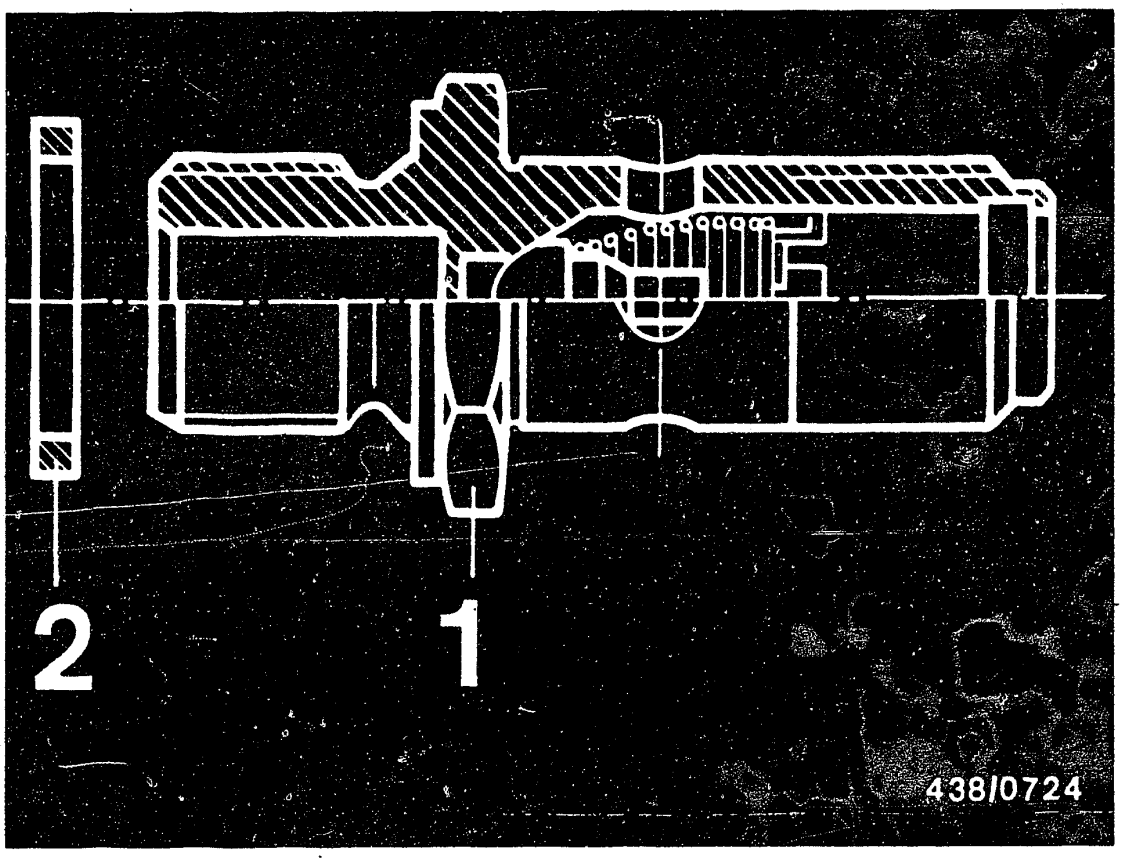
1 = Electric fuel pump
2 = Flat seal
3 = Threaded nozzle

17.4 Possible primary pressure circuit faults

- Leaking check valve in the threaded nozzle of the electric fuel pump.

Vehicles with a separate electric fuel pump.
Electric fuel pump order number: 0 580 254 957/958

The check valve is an integral part of the threaded nozzle.



1 = Threaded nozzle with integral check valve
2 = Flat seal

Parts set: 1 587 010 002

If necessary, replace the threaded nozzle using parts set 1 587 010 002 as follows:

Thoroughly clean the electric fuel pump delivery connection.

Clamp off the suction hose from the fuel tank to the electric fuel pump (e.g. using shutoff clamp W 157 made by the Matra Company).

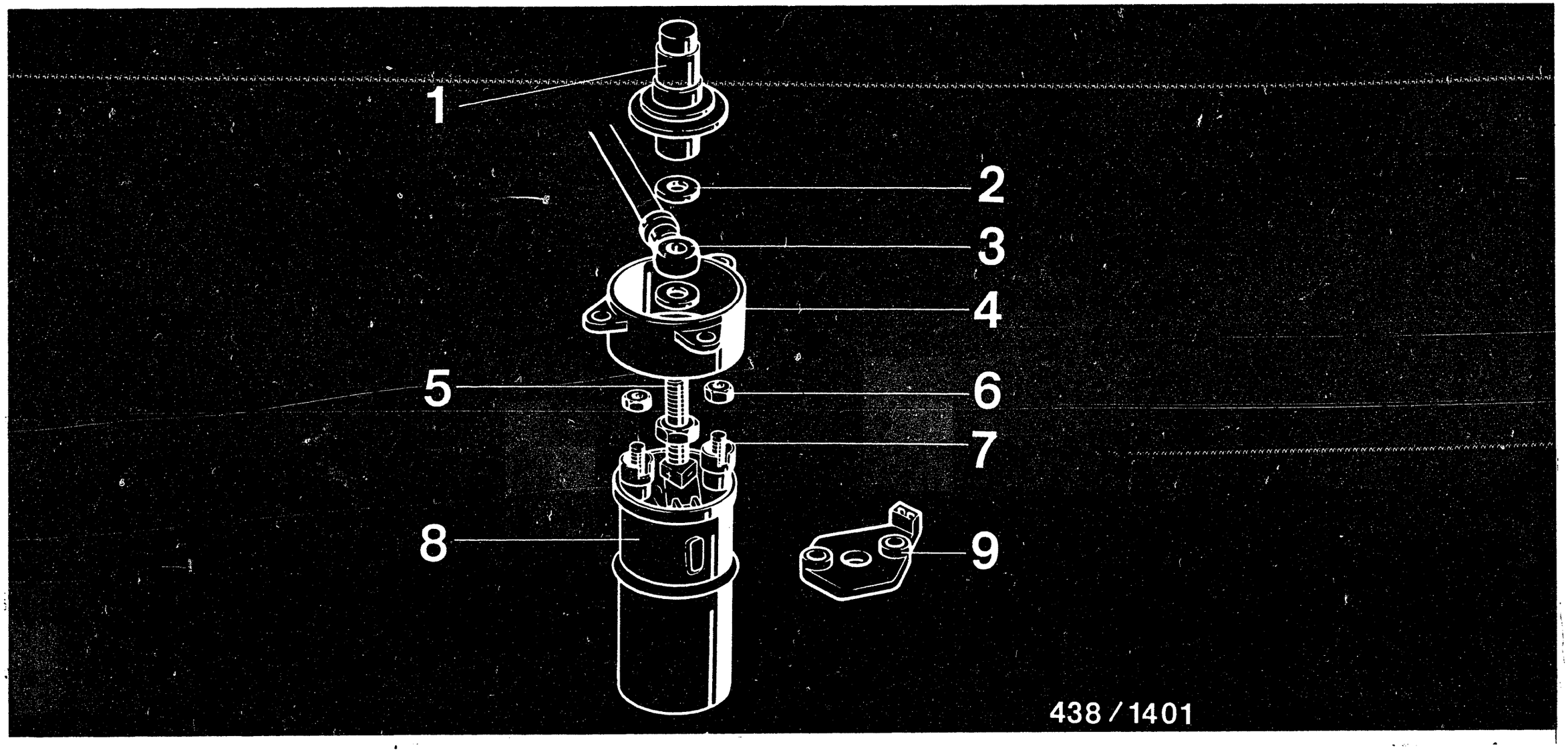
Unscrew the delivery line and catch gasoline in a suitable container.

Unscrew defective threaded nozzle.

Screw a new threaded nozzle (short end) into the delivery nozzle using a thick flat seal and tighten to a torque of 17 ... 25 Nm.
Back up the delivery nozzle by holding a wrench on its hexagonal surface.

Slide a thin flat seal, banjo union and the other flat seal onto the long end of the threaded nozzle and tighten the hexagonal cap nut.
Remove the shutoff clamp from the suction hose.

Allow the electric fuel pump to run and check all connections for leak-tightness.

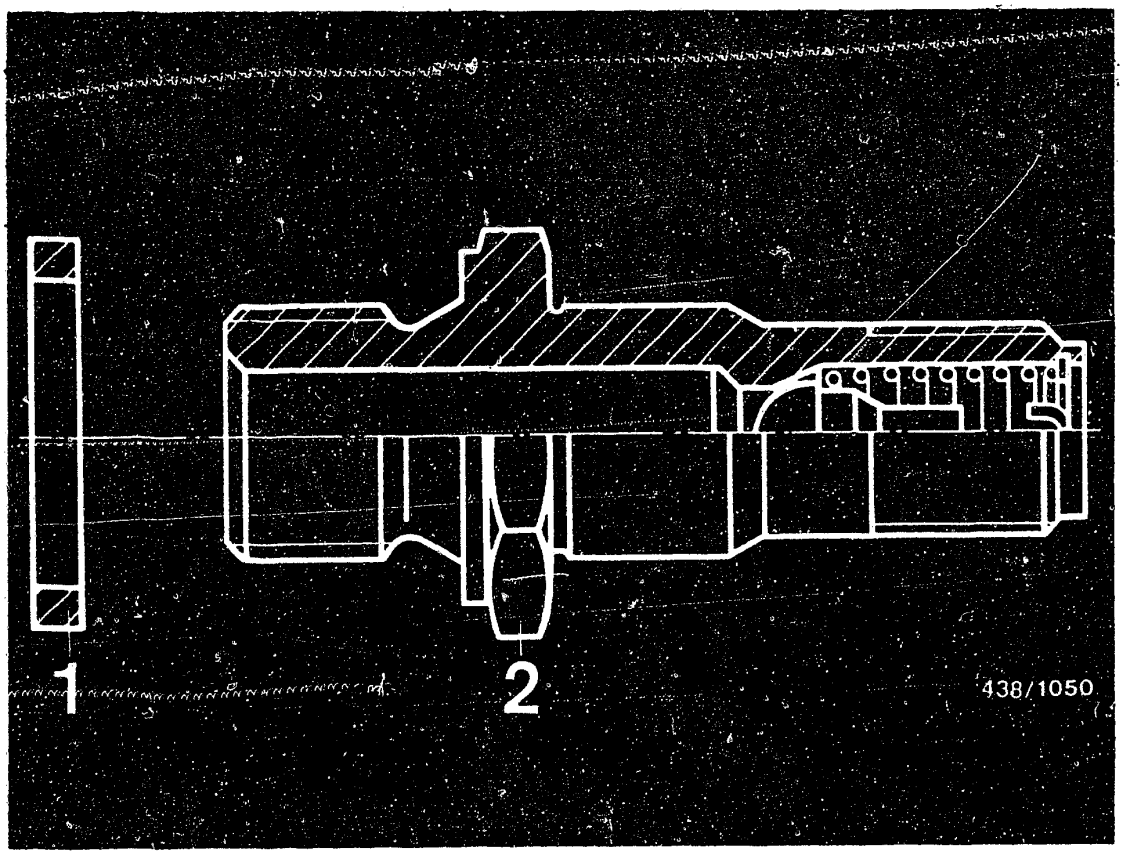


1 = Pressure damper
2 = Seal ring
3 = Flow line
4 = Retaining ring
5 = Non-return valve
6 = Hexagon nut
7 = Electrical connections
8 = Electric fuel pump
9 = Electric plug

o Non-return valve in tube fitting of in-tank electric fuel pump leaking

Part number of electric fuel pump: 0 580 254 012

The non-return valve is integrated in the tube fitting.



1 = Flat seal
2 = Threaded nozzle with integral check valve

Parts set: 1 587 010 500

If necessary, replace the threaded nozzle using parts set 1 587 010 500 as follows:

Remove complete unit (electric fuel pump, non-return valve and pressure damper).

Unscrew the pressure damper and remove the feed line with flat seals.

Unscrew the threaded nozzle with defective check valve.

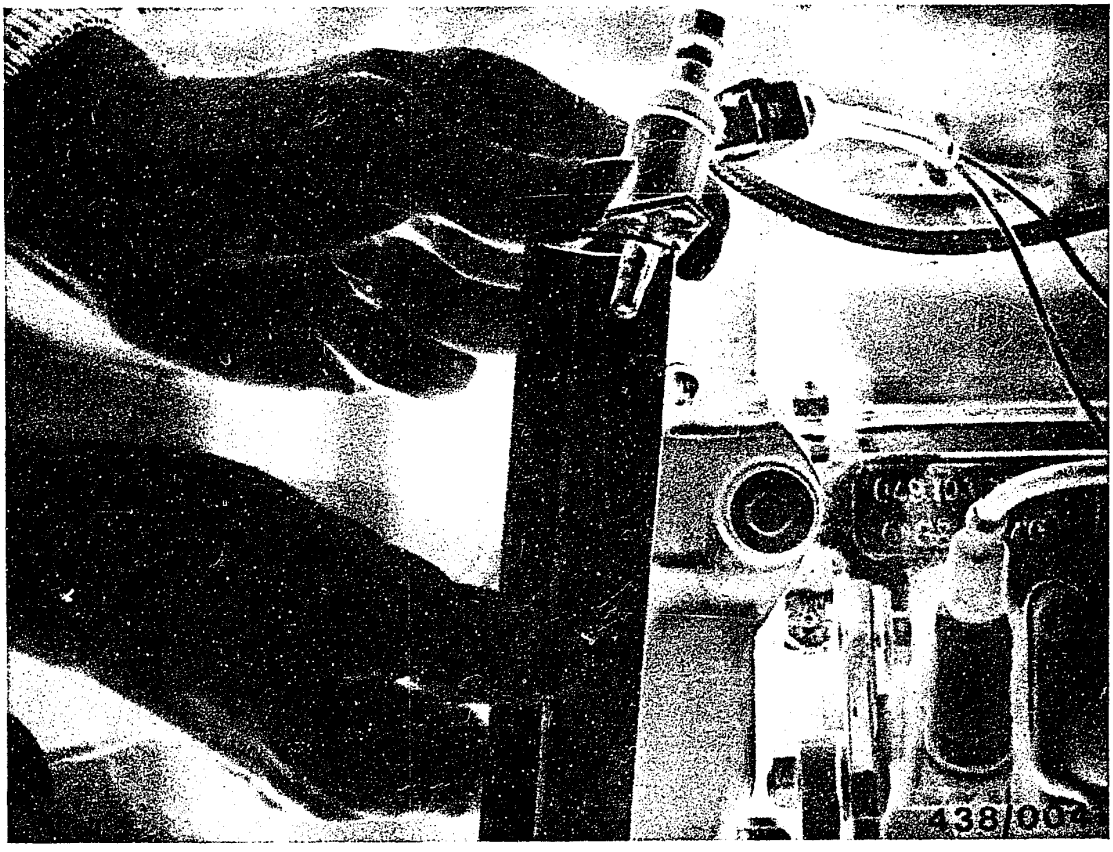
Screw a new threaded nozzle (short end) into the delivery nozzle using a thick flat seal and tighten to a torque of 17 ... 25 Nm.

Back up the delivery nozzle by holding a wrench on its hexagonal surface.

Slide a thin flat seal, banjo union and the other flat seal onto the long end of the threaded nozzle and tighten via the pressure damper.
Tightening torque: 17 ... 25 Nm

Reinstall the complete unit, making sure that the electric fuel pump is in the correct position.

Make sure there are no kinks in the fuel lines.



- Start valve leaking

Remove start valve; hose line remains connected.

Hold start valve in container (e.g. measuring glass).
Switch on electric fuel pump by jumping the electrical safety circuit.
Dry off nozzle of start valve.
No drop of fuel may fall from the nozzle within 1 minute. Even if shaken and knocked the start valve must not leak.
Then switch off electric fuel pump again. Replace start valve if leaking. Finally, perform idle adjustment with engine at normal operating temperature.

Idle adjustment is described on Coordinate H 1.

- Stepping valve leaks

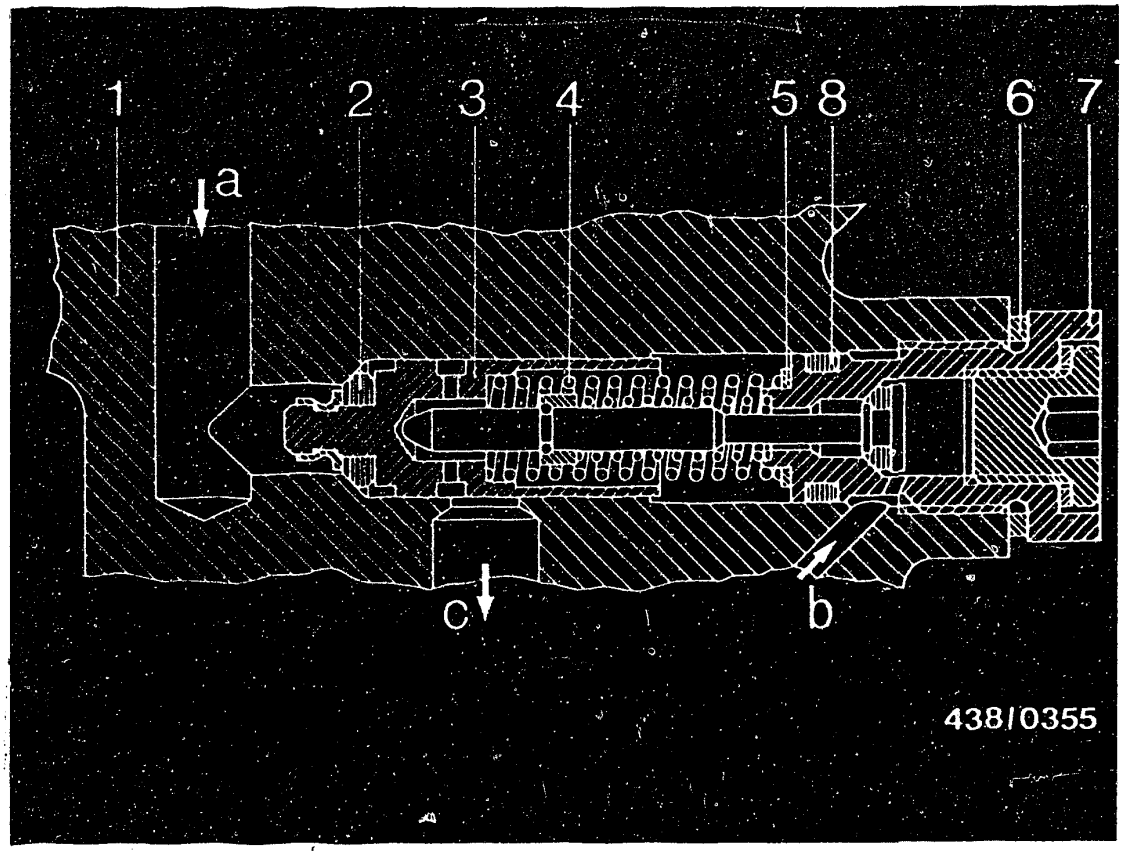
Remove the stepping valve return line at the junction and unplug the electrical connector.

Run the electric fuel pump by bridging the electrical safety circuit.

Dry off the fitting at the end of the line.

Fuel must not drip from the fitting for 1 minute.

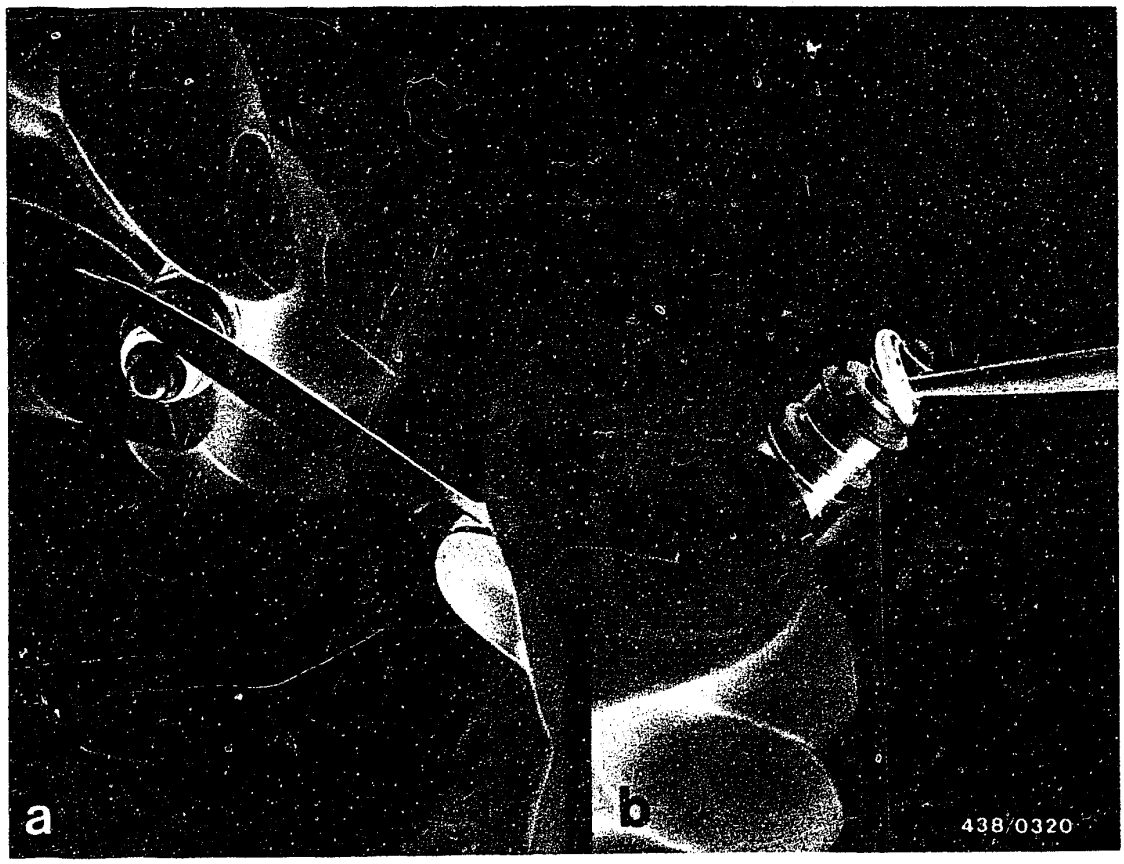
Turn off the electric fuel pump and replace the defective stepping valve.



a = Primary pressure
b = From the warm-up regulator
c = Fuel return outlet
1 = Fuel distributor housing
2 = Contoured seal
3 = Control plunger
4 = Control spring
5 = Shim(s)
6 = Flat seal
7 = Screw plug
8 = O-ring

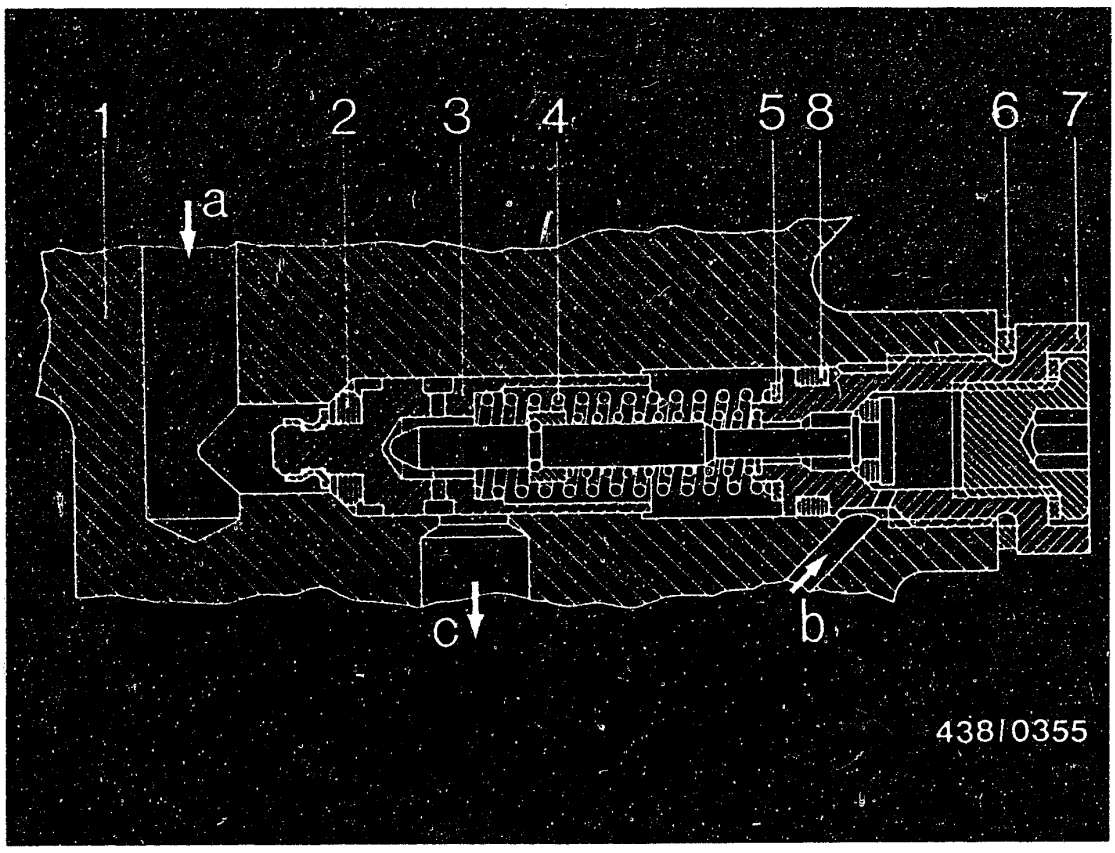
- Leaking contoured seal on control piston of primary pressure regulator

Replace contoured seal:
Clean the fuel distributor in the vicinity of the primary pressure regulator. Unscrew the large plug (7) with complete push valve. Also remove the shims (5), control spring (4) and control plunger (3).



The seal is replaced as follows without removing the retaining ring:
Cut the old seal apart and remove (Fig. a). Using a blunt marking tool, pull the new seal over the retaining ring (Fig. b). Do not overstretch the seal.

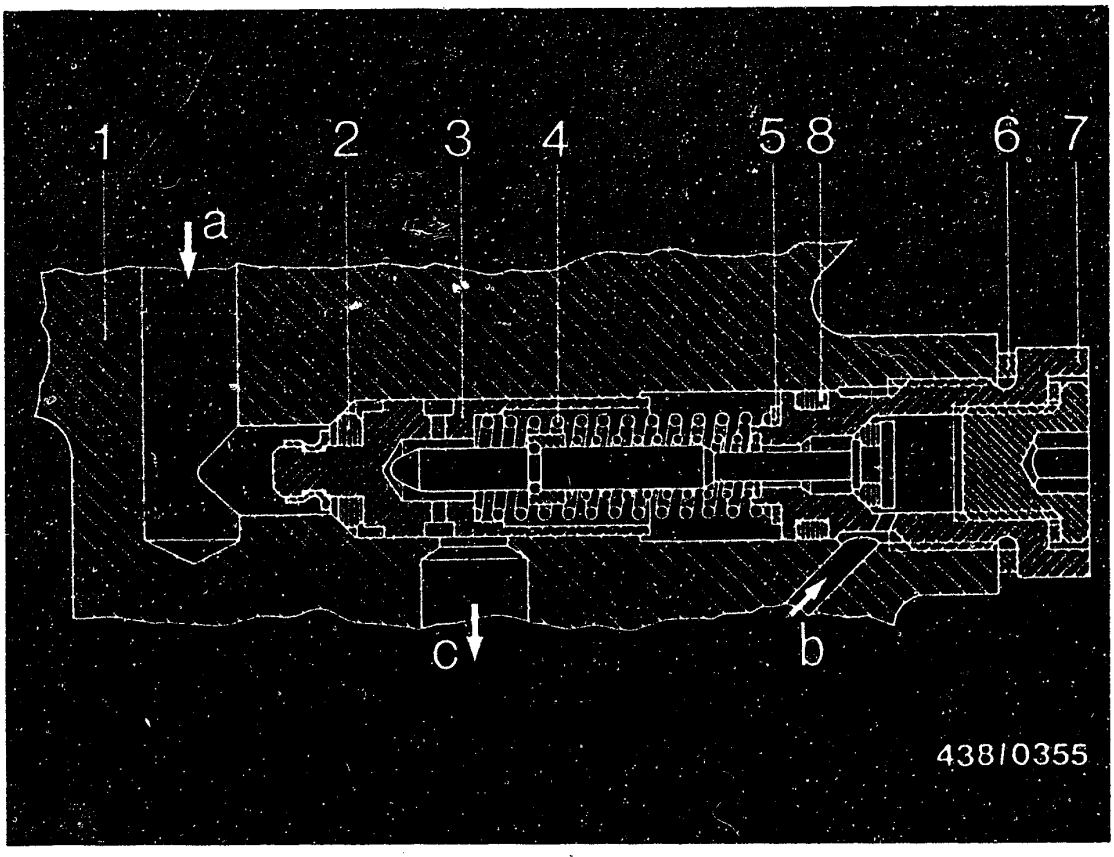
Then carefully check to make sure that the new seal is not damaged. The retaining ring must be loose enough to turn by hand. Check to make sure that there is a gap of approx. 0.2 mm between the retaining ring and the seal.



Then check the primary pressure and reset if necessary by replacing the shims (5).

Primary pressure test and setting values (gauge pressure)

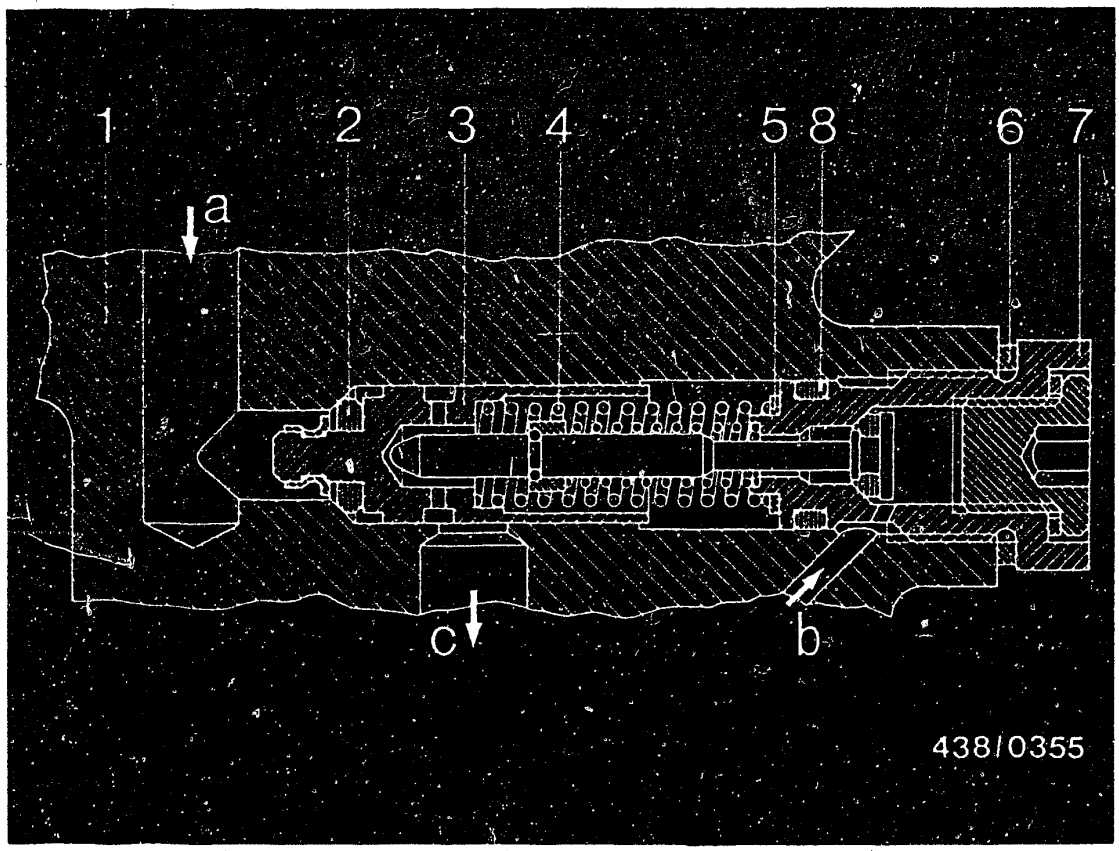
Fuel distributor order number:	Test values:	Setting values:
0 438 100 116	4.7 ... 5.4 bar (4.8...5.5 kp/cm²)	4.9 ... 5.1 bar (5.0...5.2 kp/cm²)



a = Primary pressure
b = From the warm-up regulator
c = Fuel return outlet
1 = Fuel distributor housing
2 = Contoured seal
3 = Control plunger
4 = Control spring
5 = Shim(s)
6 = Flat seal
7 = Screw plug
8 = O-ring

17.5 Possible faults in the control pressure circuit

Leaking push valve in the primary pressure regulator. The seal in the push valve is vulcanized onto the valve needle.



For this reason, if leaks are found replace the entire push valve as a complete unit.

Clean the fuel distributor in the vicinity of the primary pressure regulator. Unscrew the large plug (7) with complete push valve. Be careful not to lose the control spring (4) and shims (5).
Install a new push valve with the same number of shims (5), new O-ring (8) and flat seal (6).
Then recheck the primary pressure and set if required by replacing the shims (5).

System pressure test and setting values (gauge pressure

Fuel distributor order number:	Test values:	Setting values:
0 438 100 116	4.7...5.4 bar (4.8...5.5 kp/cm²)	4.9...5.1 bar (5.0...5.2 kp/cm²)

18. TESTING THE INJECTION VALVES

Remove injection valves for testing.
When loosening the fuel lines, hold the fixed hexagonal sections of the injection valves with a wrench.
When re-installing the injection valves, the O-rings on the valve stems should if possible be replaced, Part No. 3 430 210 600, in order to prevent leaks and thus the entry of unmetered air. Also check the insulating sleeves for leaks. If necessary, tighten with angled hexagon screwdriver.

- Pay attention to fixed air-guide cap of injection valves 0 437 502 023/.. 024 and 0 437 502 026/..027. If damaged, replace complete injection valve.

18.1 Test equipment and fluids

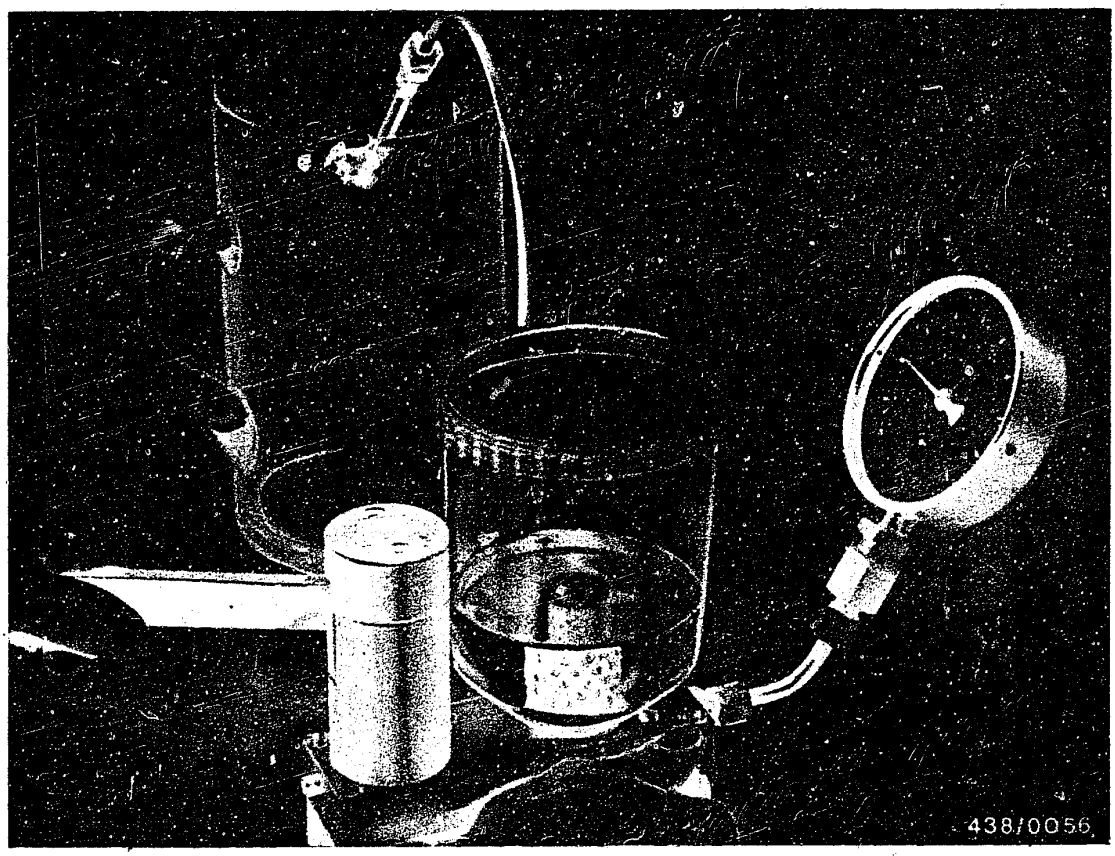
The following test specification applies to valve testers of Type KDJE-P 400 (formerly KDEP 7452) and 0 681 200 700.

Follow the test specification!

Test fluids: White spirit (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, order designation VS 14 942 - CH
formerly order number 5 973 340 650
White spirit is available in 5-liter containers from the following company:
Oskar Gnamm GmbH & Co.
D-7531 Kaempfelbach-Bilfingen, W. Germany

Caution!

For reasons of safety, gasoline or similar highly-flammable or combustible liquids must never be used. Follow local official regulations even when using white spirit.

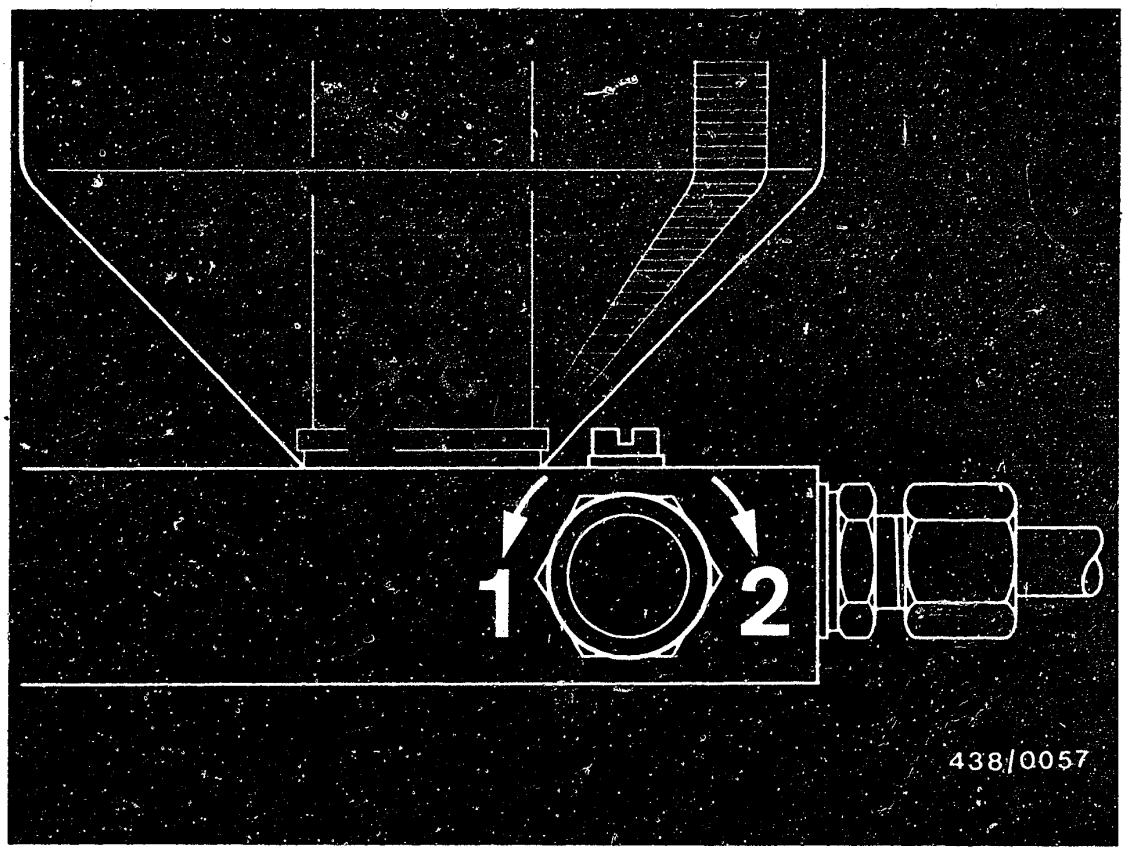


18.2 Connecting the injection valve to the tester

Connect the injection valve to the valve tester and bleed the delivery line by operating the lever several times with the union nut open. Then tighten the union nut.

18.3 Checking for dirt

Move the hand lever slowly (about 2 seconds per stroke) back and forth with the stopcock on the pressure gauge open. If the pressure does not build up to 1...1.5 bar gauge pressure, the injection valve has a bad leak (caused, for example, by dirt stuck in it).
You can try to flush the injection valve clear by moving the lever back and forth several times strongly. If this attempt is successful, continue the test. If it is not possible to flush the valve clear, replace it.

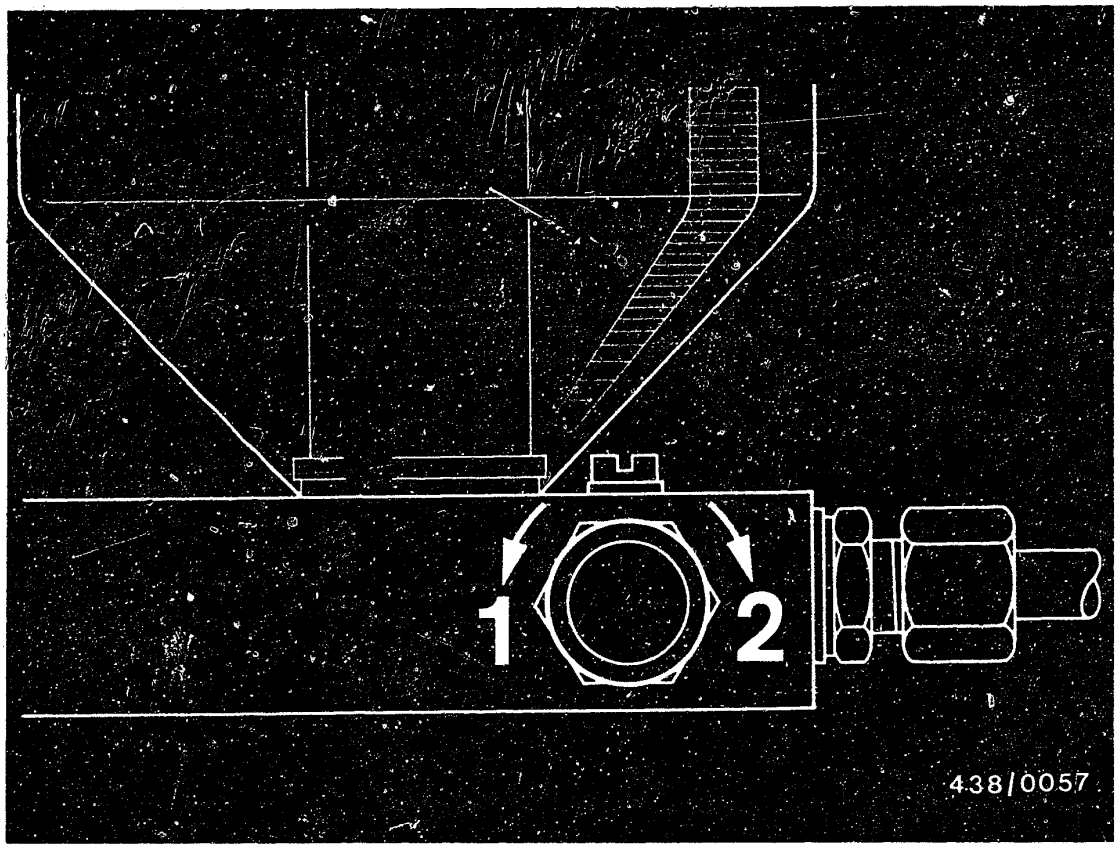


1 = Open 2 = Closed

18.4 Testing the opening pressure

Injection valve Part No.	Test specifications - opening pressure (gauge pressure)
0 437 502 023/..024 0 437 502 026/..027	3.0...4.1 bar (3.1...4.2 kgf/cm²)

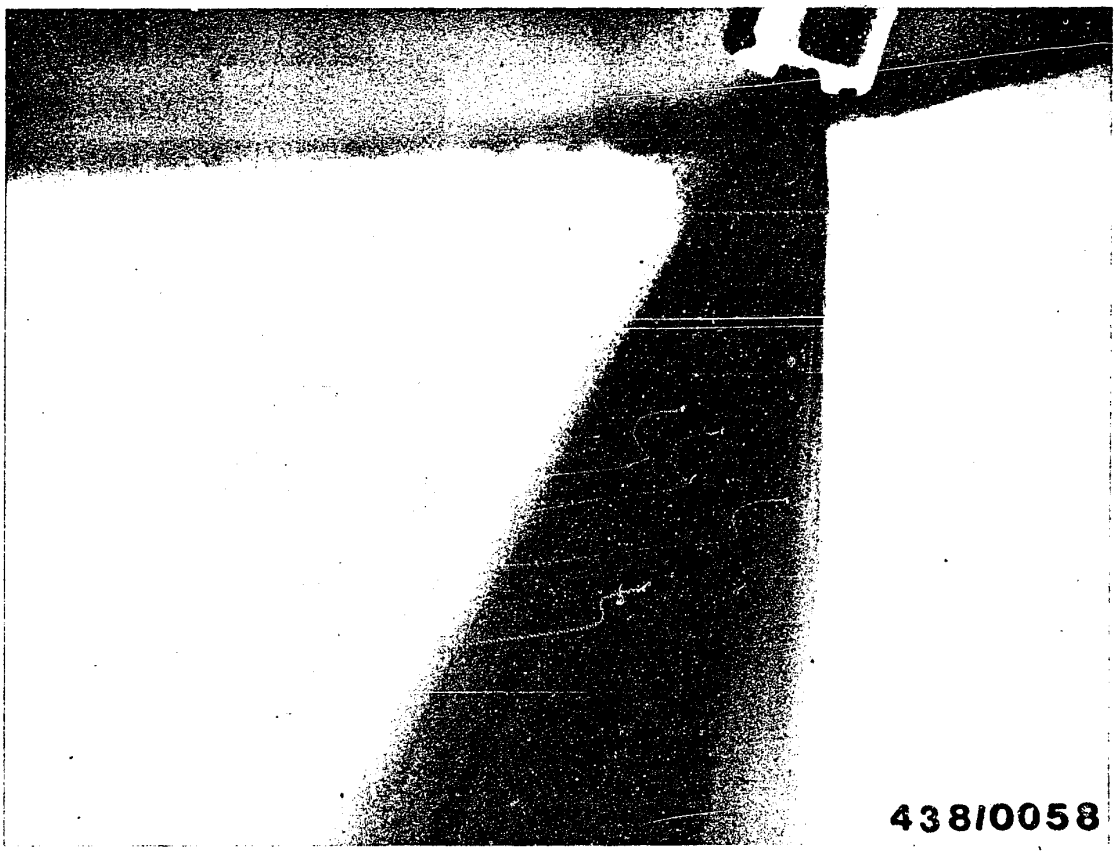
With the stopcock closed, flush the valve out and bleed it with several rapid movements of the lever.
Open the stopcock and test the opening pressure by moving the lever slowly (about 2 seconds per stroke).
If the opening pressure is outside tolerance, replace the injection valve. Individual valves can also be replaced within a set.



1 = Open 2 = Close

18.5 Leakage test

Open the stopcock, build the pressure up slowly to a value 0.5 bar under the opening pressure determined previously (but not less than 2.8 bar gauge pressure), and hold it constant at that level. No drops must now fall from the valve for the next 25 seconds.



18.6 Chatter test, evaluation of spray

Move the lever back and forth at about 1 stroke per second. As this is done, the valve must chatter. No drops of fuel must form at the mouth of the valve. The valve must not produce a "cord spray". Formation of a single-sided, atomized spray within an overall spray angle of about 35° is permissible (see example given in illustrations).

Illustration shows good spray formation.

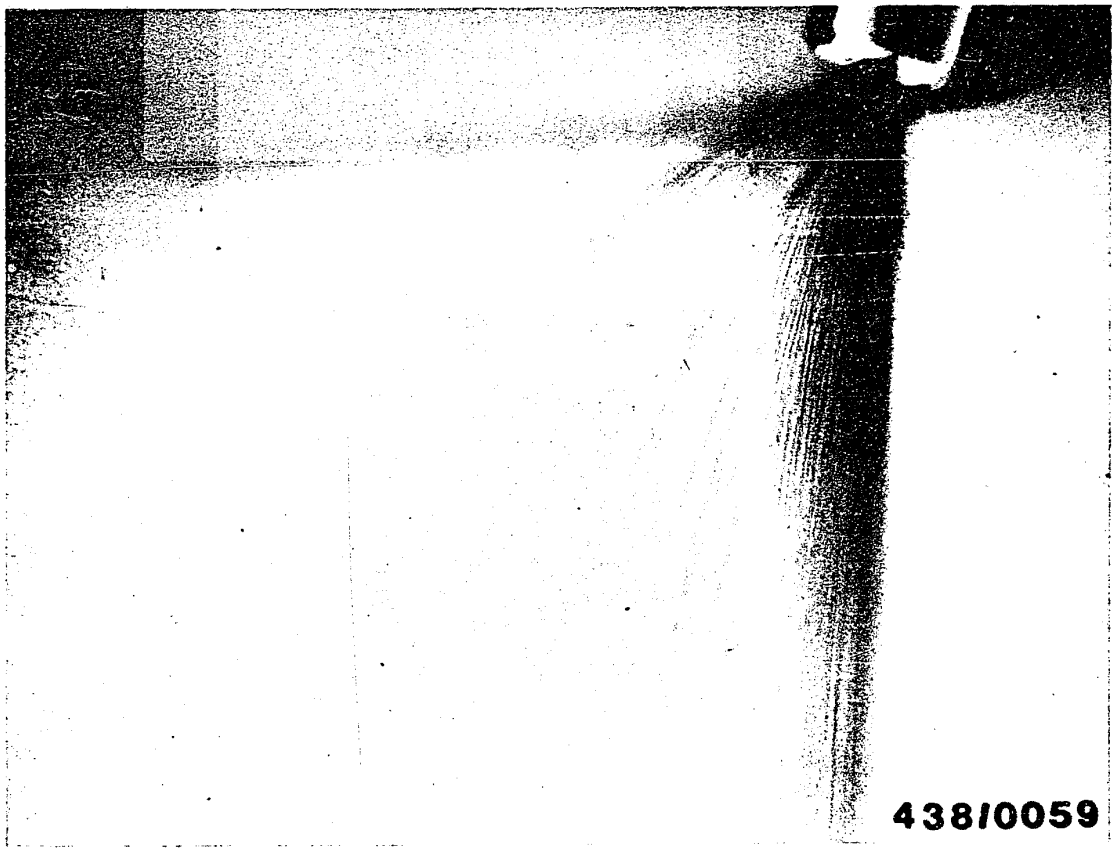
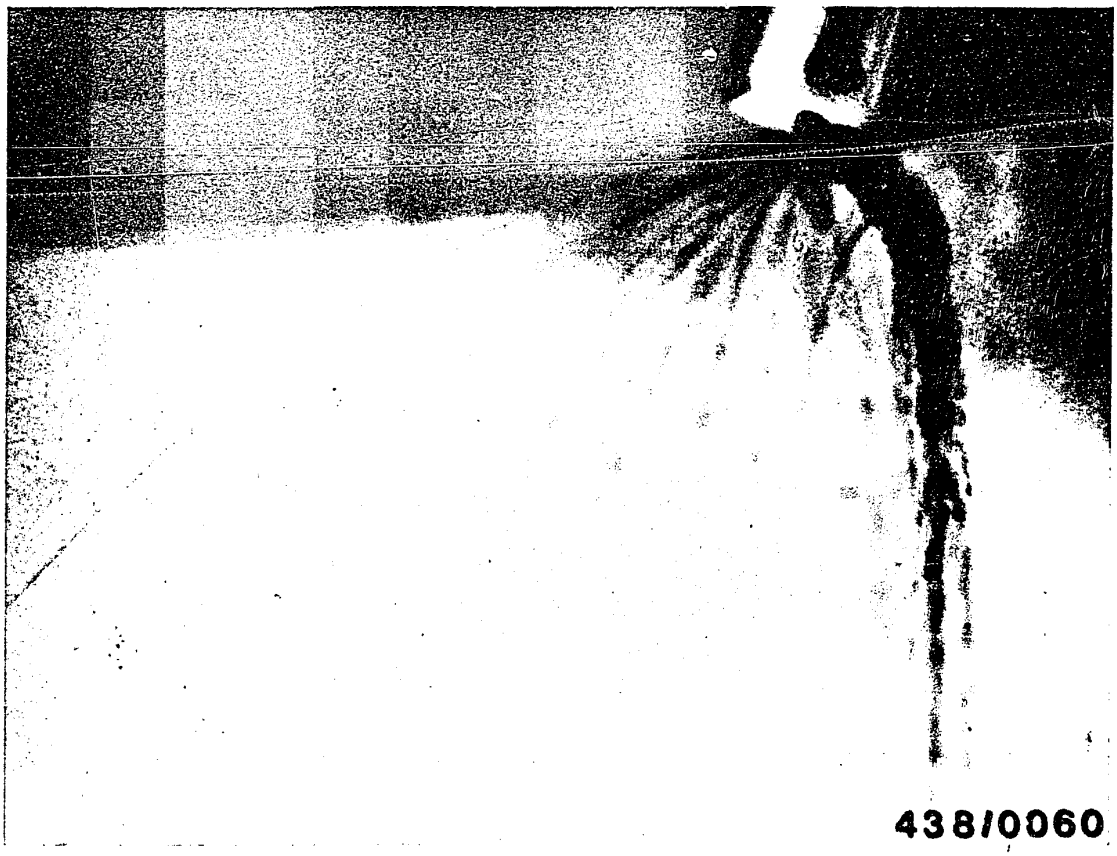
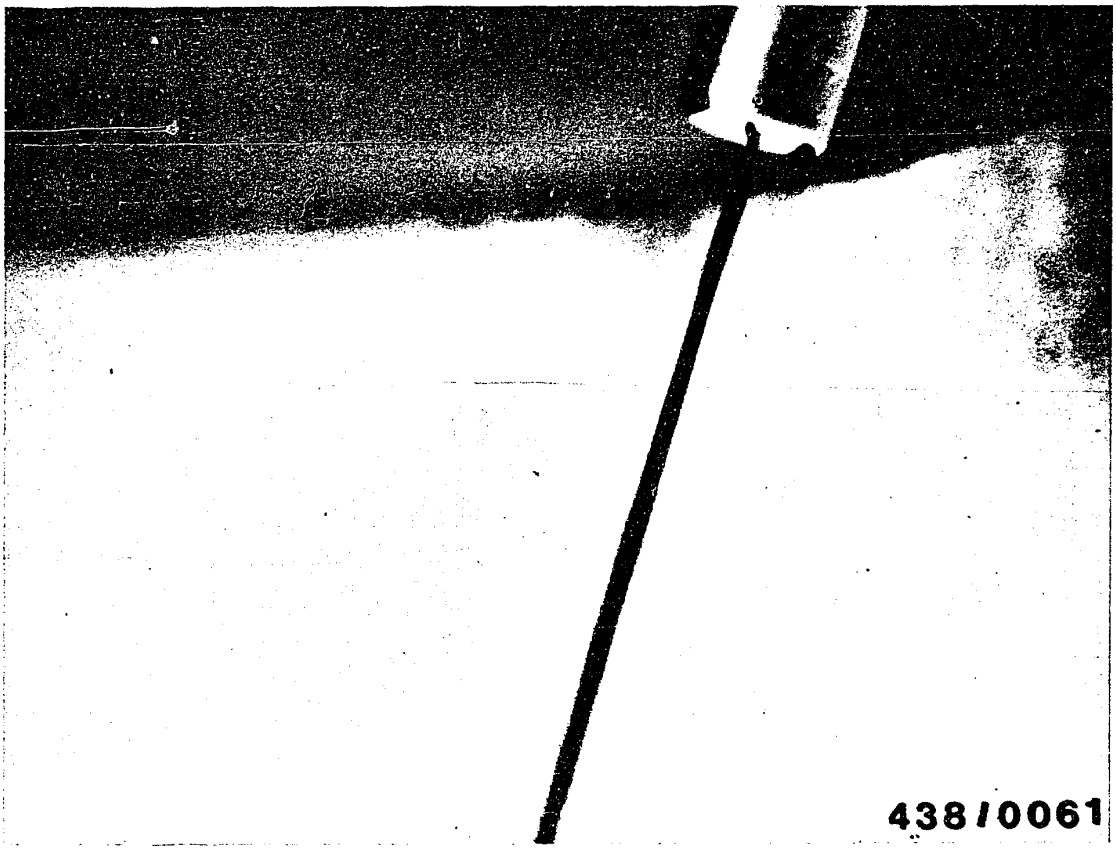


Illustration shows single-sided but nevertheless good spray formation.



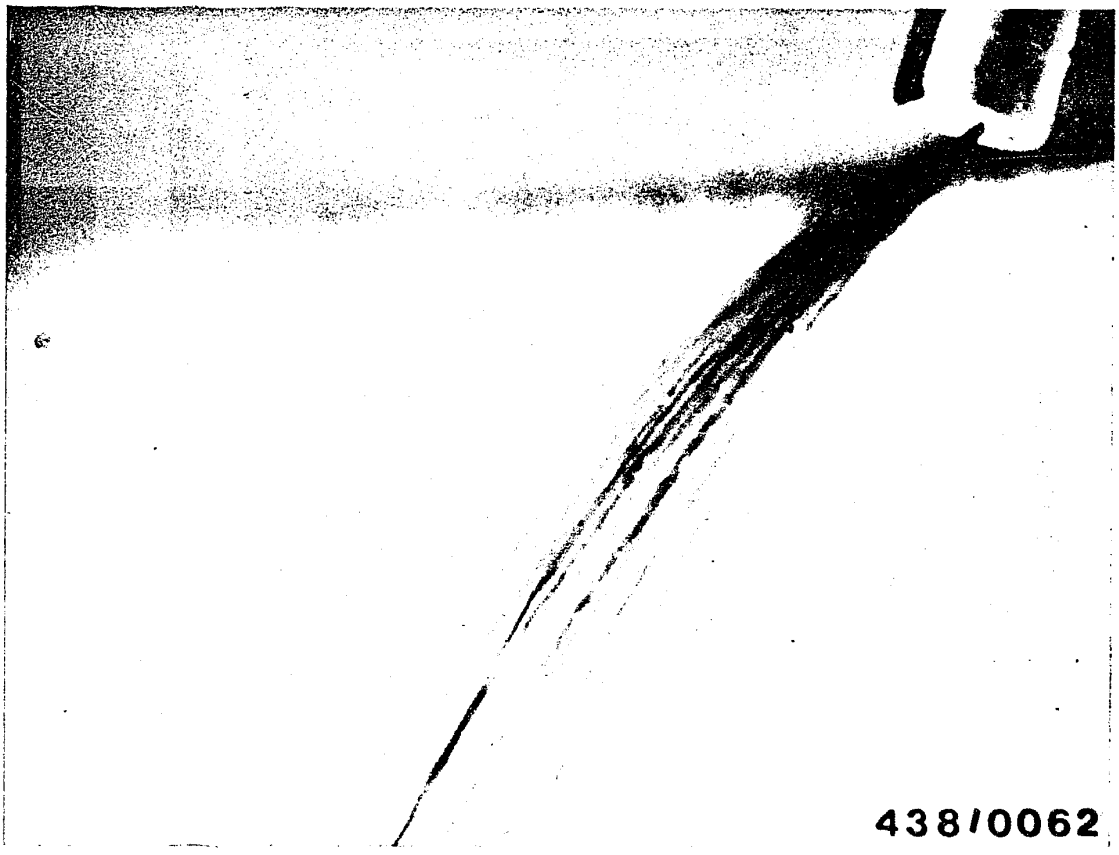
Poor spray formation; replace injection valves.

Illustration shows drop formation.



Poor spray formation; replace injection valves.

Illustration shows "cord" spray.

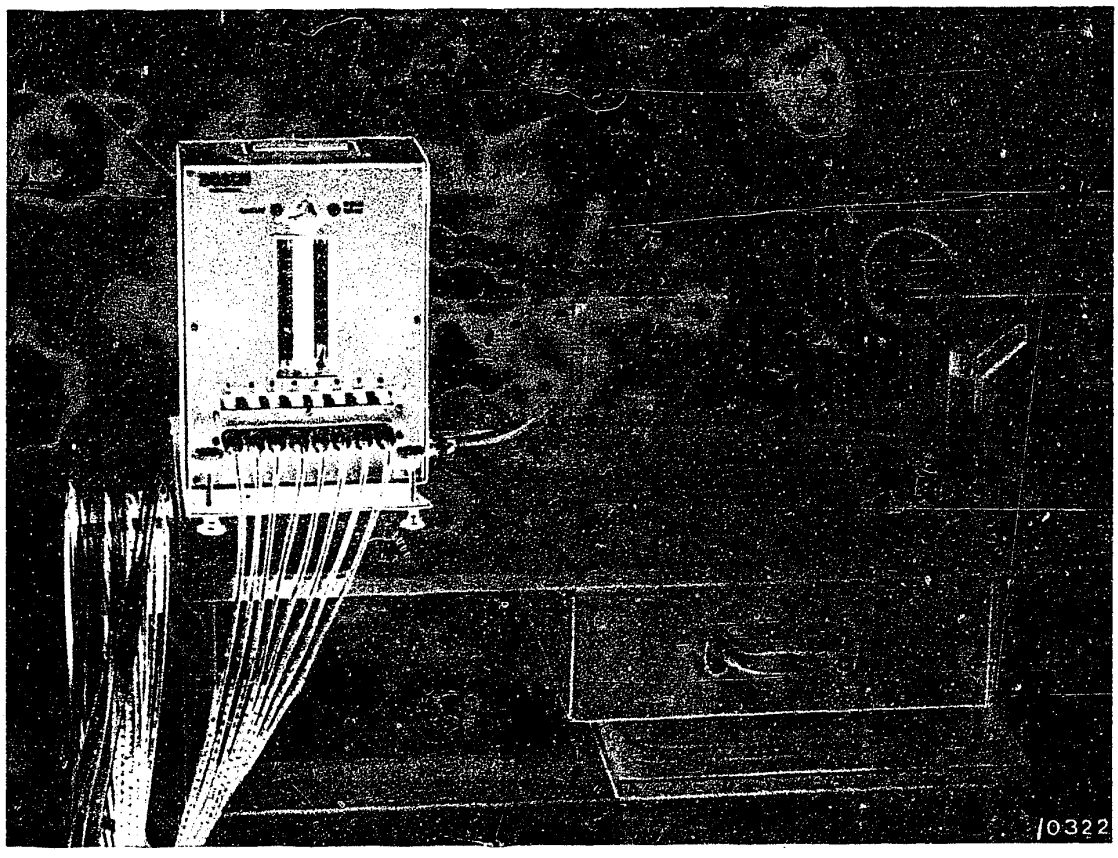


Poor spray formation; replace injection valves.

Illustration shows "spray in strands".

If defective injection valves have been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinates H 1.

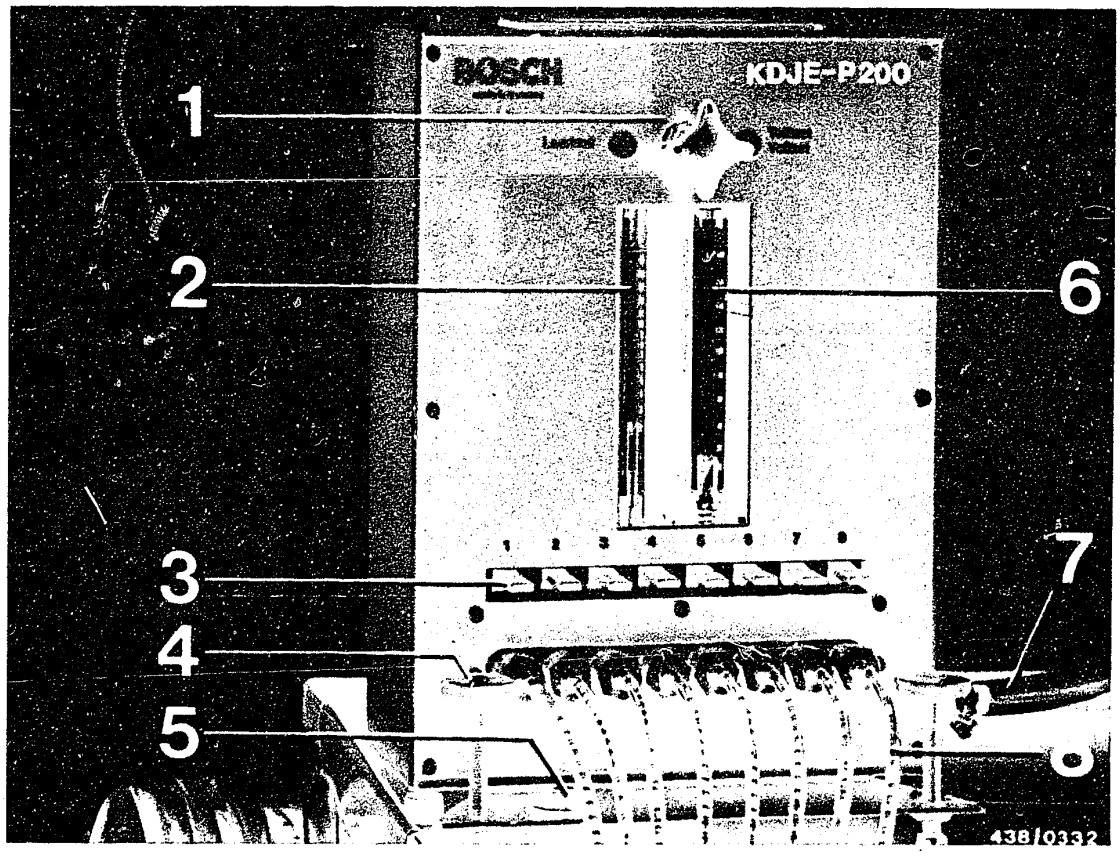


19. Comparative measurement of fuel delivery of fuel distributor outlets.

This test is carried out using the tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451).

19.1 Application

By means of comparative measurements, the differences in the amounts of fuel delivered from the individual outlets on the fuel distributor are determined.
The tester is designed so that the test can be made on the vehicle without having to remove the fuel distributor.
Since the test is made with the original injection valves, the operator can recognize at the same time whether delivered-quantity scatter, if it occurs, is caused by the fuel distributor or by the injection valves.



1 = 3-way cock
2 = Small rotameter tube
3 = Keyboard for 8-way valve
4 = Adjusting screw for setting up
5 = Spirit level
6 = Large rotameter tube
7 = Return hose
8 = Polyamide hose lines (test lines)

19.2 Construction

The tester is designed for use with all engines, up to 8 cylinders, equipped with K-Jetronic.

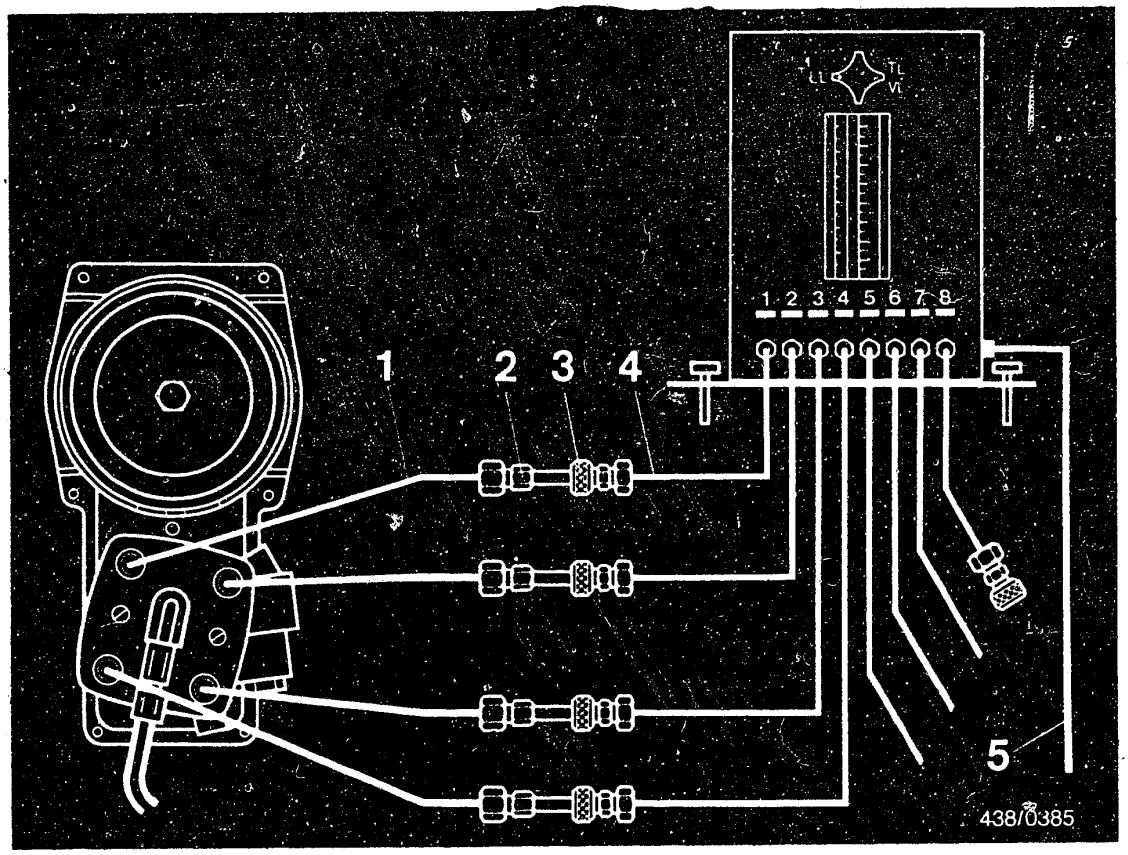
Basically, the tester consists of a steel housing containing 2 rotameter tubes with measuring ranges of 2...15 cm^3 and 10...180 cm^3, an 8-way valve for key operation (Item 3) and a 3-way stopcock (Item 1).

The small rotameter tube (Item 2) is used for the idle measurement while the large tube (Item 6) is used to measure the fuel delivery at part- and full-load. The particular rotameter tube to be used is connected by means of the 3-way stopcock. Using the 8-way valve, the fuel delivery of each cylinder is tested one after the other.

Attached to the tester are 8 hoses (Item 8), each terminated with an automatic connector. When the injection valves are withdrawn from their sockets on the engine they are attached to these connectors. Each automatic connector is fitted with a push valve so that no fuel can escape from connectors that are not in use (when 4- or 6-cylinder systems are tested).

The fuel is returned to the fuel tank through a hose (Item 7) about 5 m long.

The entire test is made with a closed circuit, i.e. no fuel escapes.



1 = Fuel distributor injection tubing
2 = Injection valves
3 = Automatic connectors
4 = Tester hoses
5 = Return line to fuel tank filler neck

19.3 Setting up and connecting the tester:

Set the tester up beside the engine on a solid base (e.g. on tester trolley KDJE-W 100) and align it with the built-in spirit level at the base of the tester.

Remove injection valves; the injection tubing remains connected.

Clean the injection valves with a rag and insert injection valves in correct sequence into the automatic connectors of the first four tester hoses.

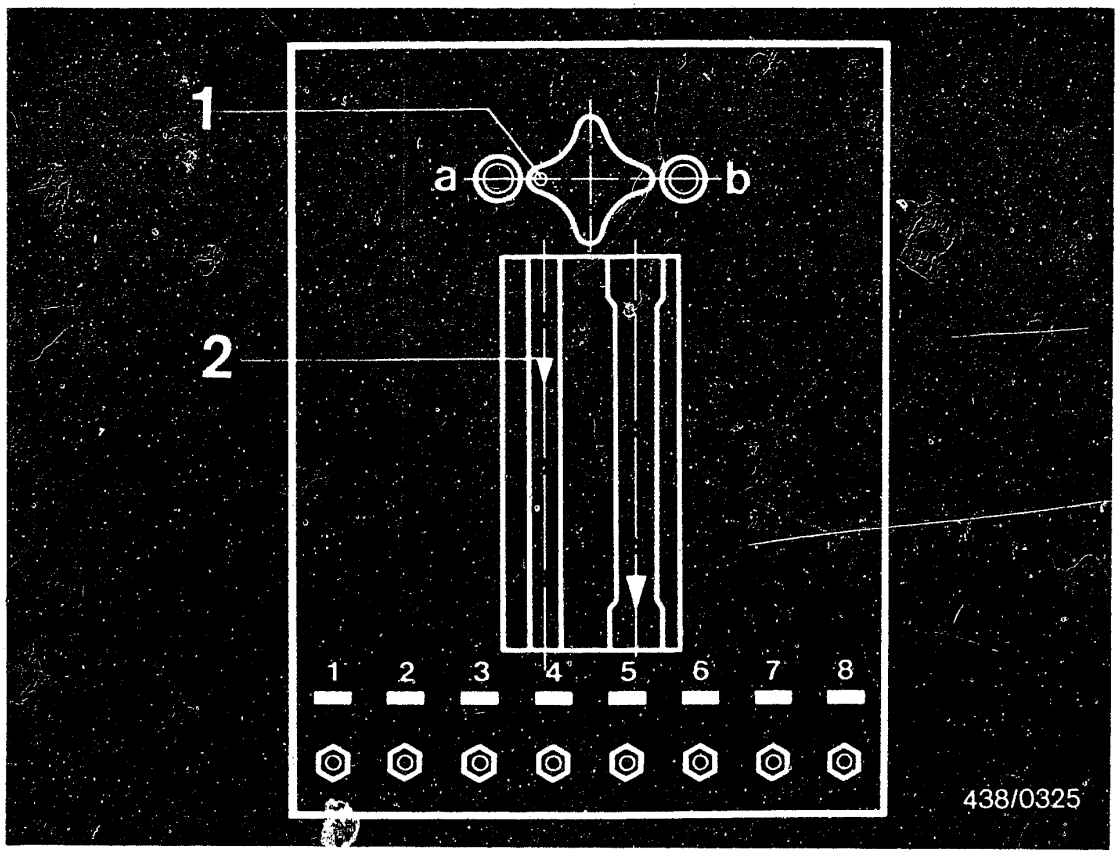
Note:
Insert the injection valves as far as they will go and tighten the knurled thumbscrews well so that the non-return valves of the automatic connectors are open fully.

For injection valves with fixed air-guide cap 0 437 502 023/... 024 and 0 437 502 026/ ... 027 use adapter sleeve KDJE-P 200/19.

Introduce the return hose of the tester into the fuel tank filler neck.

19.4 Bleeding the tester:

Remove the rubber hood (loosen 2 clamping bands) so that air-flow sensor plate becomes accessible.
Remove the electric plugs from the warm-up regulator and the auxiliary-air device.
Switch on the electric fuel pump by bridging the electrical safety circuit.
Raise the air-flow sensor plate to the stop.
Press the keys on the 8-way valve one after the other, while simultaneously switching the 3-way stopcock until both rotameter tubes are bled.
Return the sensor plate to the rest position.



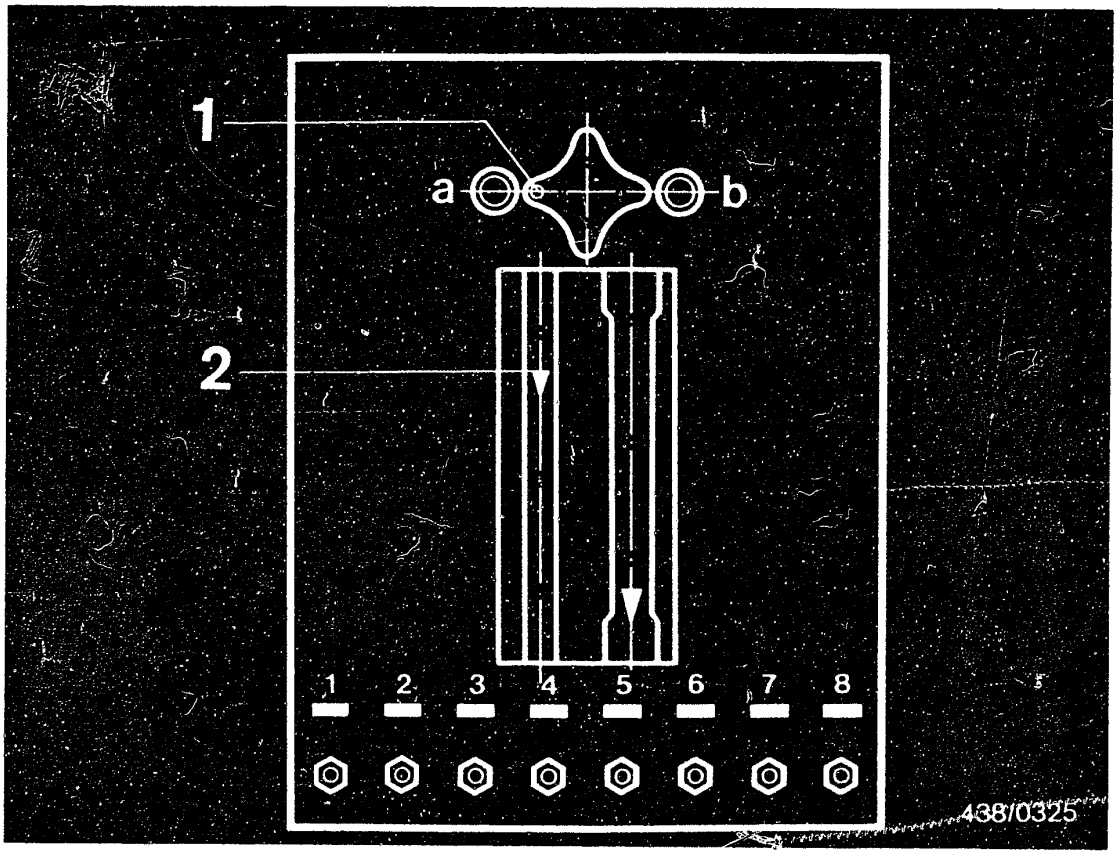
1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

19.5 Testing:

The flow comparison measurement is made in the idle, part-load and full-load ranges.

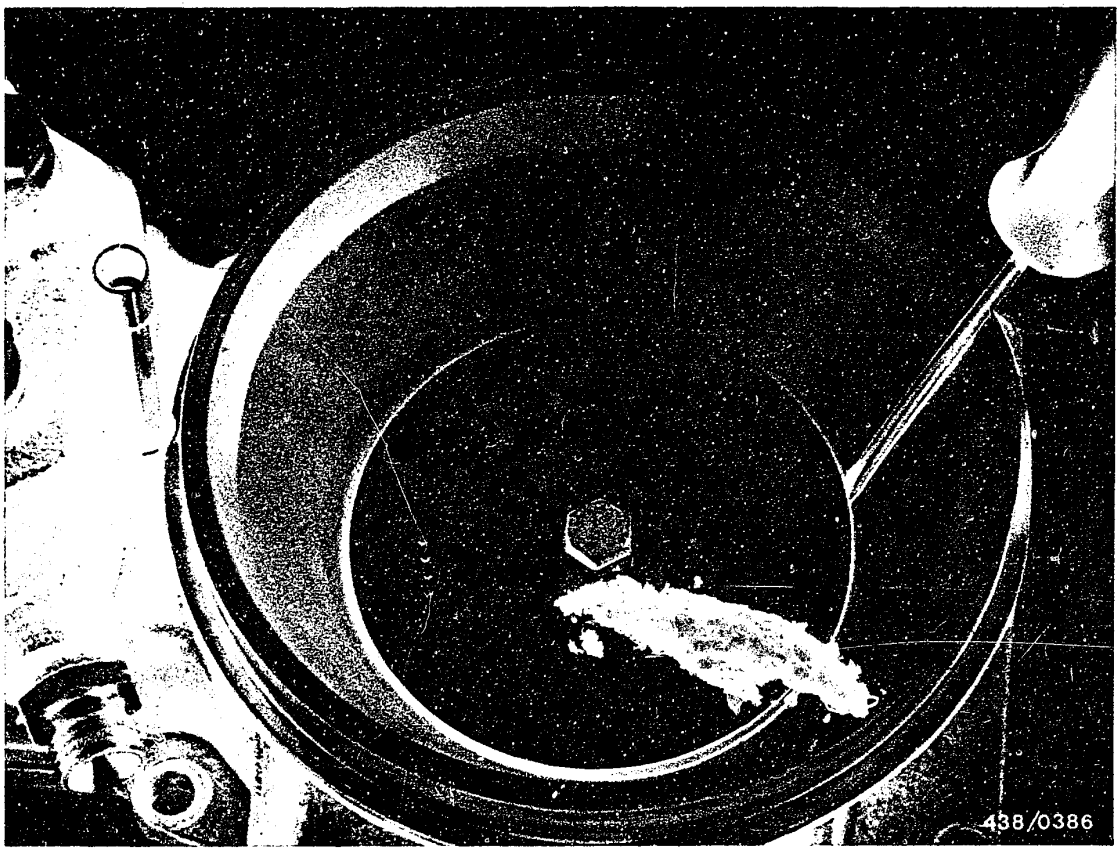
The small rotameter tube is to be used for the idle measurement (white dot to the left on control knob); part-load and full-load measurements are made using the large rotameter tube (white dot to the right).



1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

The delivered quantities indicated on the rotameter tubes are read off at the top edge of the conical float (Item 2). On testers with a ball float the uppermost point of the ball is used for reading off. With each measurement be sure to wait until the float has reached its final position. This may take 20...30 seconds in the case of small deliveries.

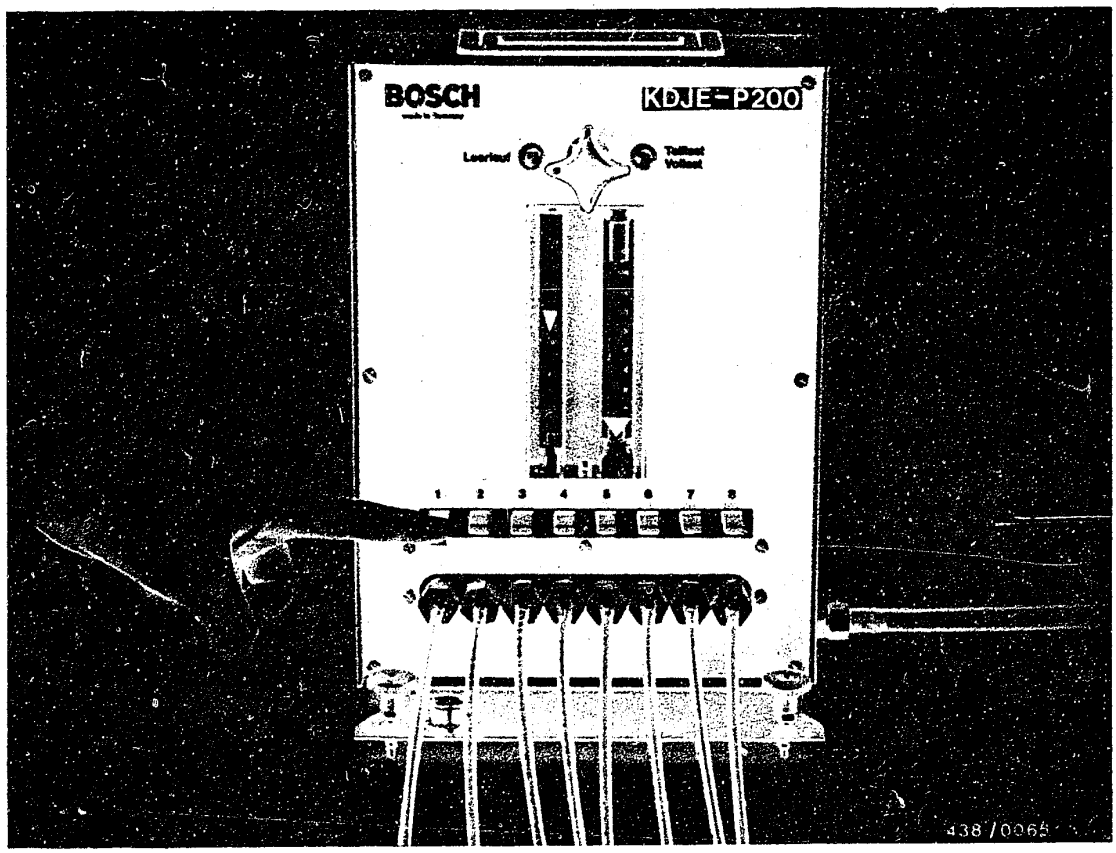


The exact setting and locating of the position of the air-flow sensor plate for the various load ranges is done using a screwdriver (a small one for the idle-position), which is inserted to an appropriate depth between the air funnel and air-flow sensor plate.

Procedure:

Switch on the electric fuel pump by bridging the electrical safety circuit.
Fixed numerical values are specified in the following test section for the maximum permissible fuel delivery differences for the individual load ranges.

The "set point" value always pertains to the fuel-distributor outlet with the lowest fuel delivery, i.e. in each case the outlet with the lowest delivery is to be first ascertained.



Press the key for outlet 1. Pivot the air-flow sensor plate until the corresponding rotameter tube approximately indicates the "set point" value. Fix the air-flow sensor plate in this position.

Test the remaining outlets in order to determine which outlet has the lowest fuel delivery.

Press the kex for this outlet again, and set the delivery precisely to the "set point" by correcting the position of the air-flow sensor plate. Then fix the air-flow sensor plate in this position again.

Press the remaining keys one after the other, and determine the maximum fuel delivery of each outlet. A deviation in fuel delivery can only be above the "set point".

19.6 Test values

Fuel distributor order number	Setting point	Maximum permissible delivery rate
0 438 100 116	(cm³/min)	(cm³/min)
Idle	6.0 cm³/min	6.6 cm³/min
Part load	40.0 cm³/min	43.0 cm³/min
Full load	122.0 cm³/min	134.0 cm³/min
This full-load delivery rate must be achieved or exceeded with the sensor plate at maximum deflection.		

If excessive deviations are found in one of the three load ranges, repeat the test a second time.

If the results of the second test are the same as those of the first, determine whether the fault lies with the fuel distributor or the injection valves.

To do this, switch the injection valves with the highest and lowest delivery rates.
If the test result remains the same, the fuel distributor is defective. If the fault follows the switched injection valves, the injection valves are defective.
Replace the defective fuel distributor or injection valves.

19.7 Concluding work

Inspect the seals on the injection valve stems for damage and deformation, and replace if necessary (order number 3 430 210 600).

Also check the insulating sleeves. If necessary, tighten using a hexagonal offset wrench.

Properly reinstall the injection valves. Replace the rubber cover. Make sure all lines are routed correctly.
Enable the K-Jetronic electrical safety circuit (replace relay). Test run the engine and check to make sure that all line connections are leak-tight.

Then check the idle adjustment and reset if necessary.

The idle adjustment procedure is explained at coordinates H 1.

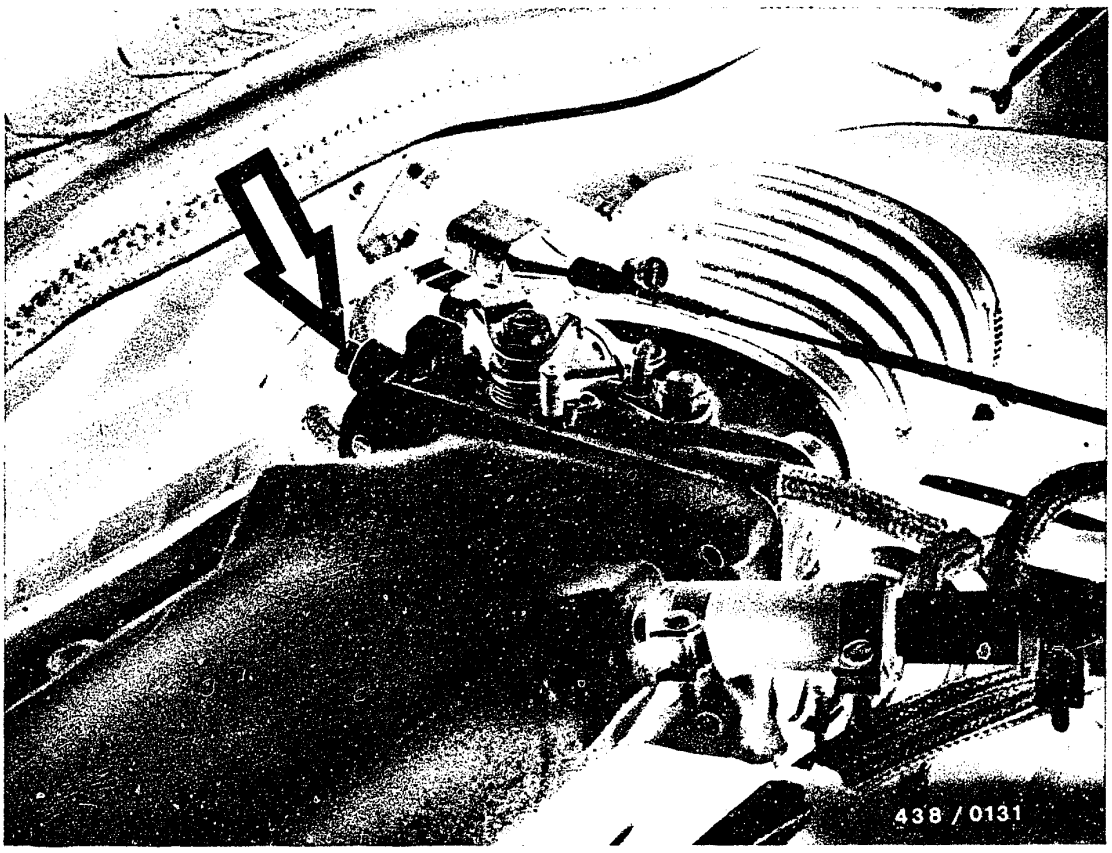
20. Idle adjustment

20.1 Test conditions:

Warm the engine up for the idle adjustment (oil temperature approx. 80° C).

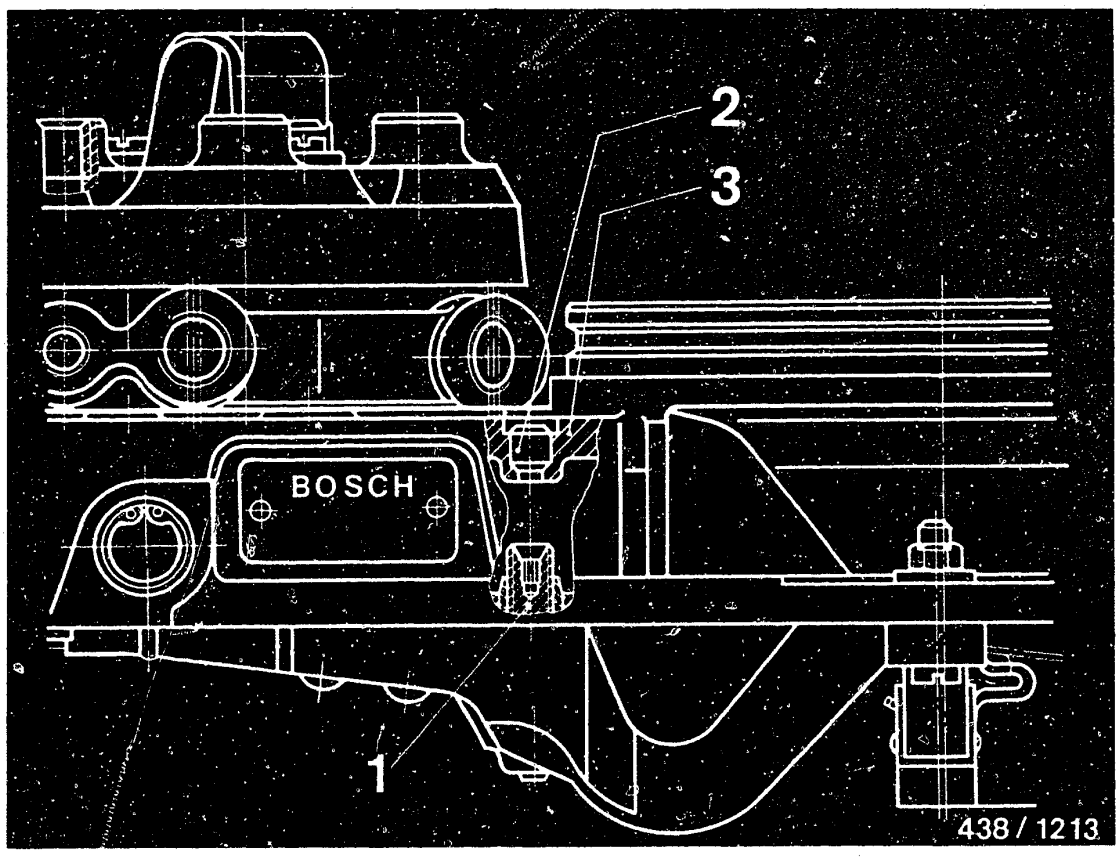
Important note:

- If fuel-injection tubing or injection valves were loosened or removed, the engine should be warmed up under load. The low rate of fuel flow during idling is not always adequate to drive all the air out of the fuel-injection tubing.
- The idle speed must not be adjusted when the engine is too hot, e.g. immediately after being raced or after a power measurement on the roller-type test stand.
- Switch on the upper beam (lowering the idle speed).
- Remove crankcase breather hose from cylinder head cover and seal off end of hose.
- In vehicles with an air conditioner, this should be switched off to stabilize the engine speed for the idle adjustment.
- Before adjusting, check whether the throttle-plate lever is up against the idle stop. The cable should be free of tension.
- Engine-speed measurement with separate tachometer.
- As of 1985 model:
  Pinch off hose to idle valve using hose clamp.



20.2 Idle and CO correction

Concerns only vehicles of the Sweden and Switzerland version.
Remove manifold-pressure hose line (arrow) from EGR valve.
Seal off tight the end of the hose and the fitting of the EGR valve.



1 = Idle mixture screw
2 = Aluminum plug
3 = Air flow sensor

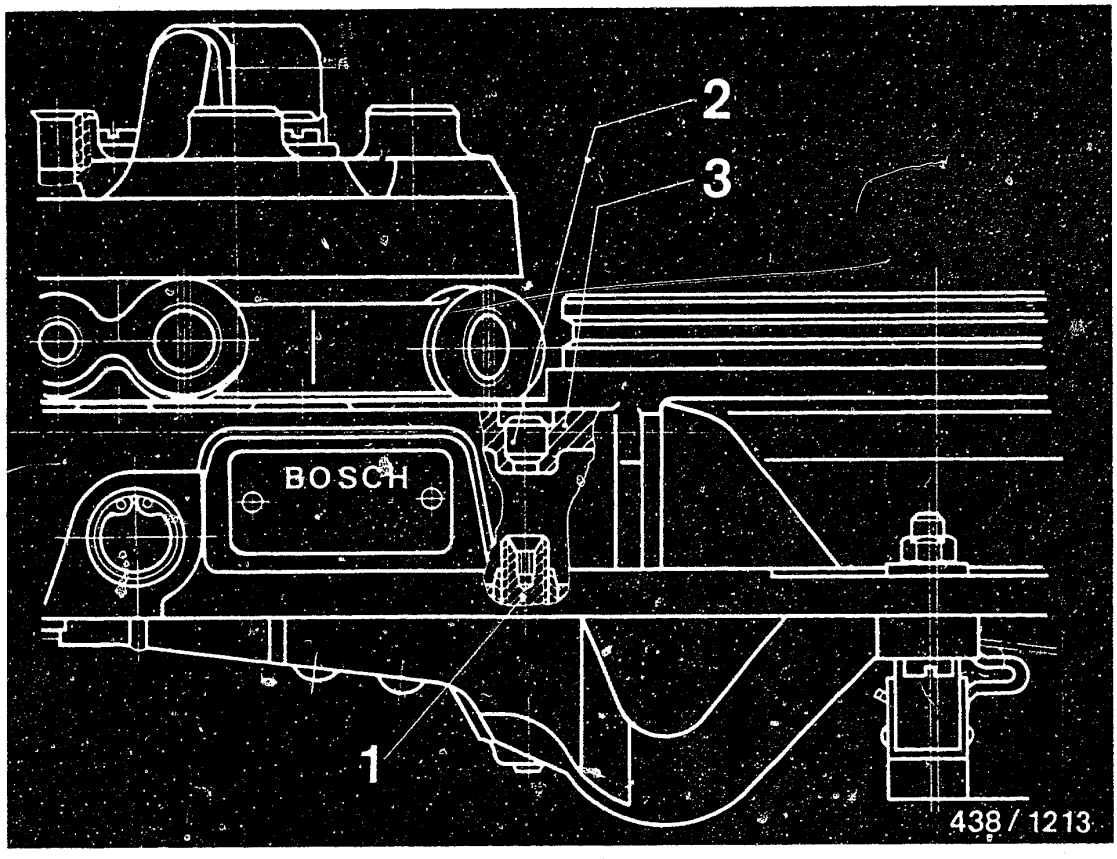
- Aluminum plug, tamper guard

The hole in the air flow sensor which provides access to the idle mixture screw has a pressed-in aluminum plug to prevent tampering. It can be removed using the same set of tools as required for removal of the ECE seal.

(e.g. No. 4521/7, Hazet Co., 5630 Remscheid, FRG)

A steel tab is inserted at the bottom of the aluminum plug to prevent full penetration by the pilot drill.

The aluminum plug has the following order number:
2 437 001 009.



1 = Idle mixture screw
2 = Aluminum plug
3 = Air flow sensor

- CO adjustment

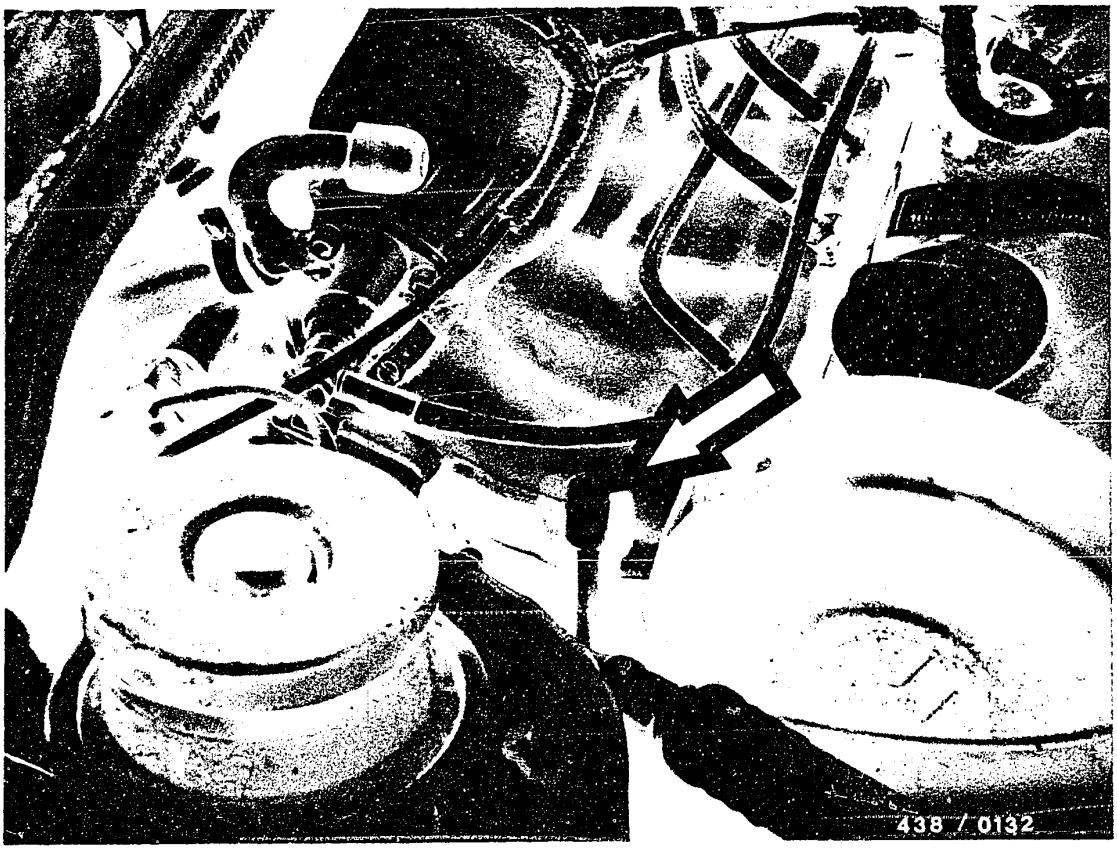
The CO value is set by turning the idle mixture screw in the mixture control unit using adjusting wrench KDEP 1035.

The adjusting wrench is inserted into the idle mixture screw after the aluminum plug is removed.

Clockwise rotation:	enriches mixture
Counterclockwise rotation:	leans out mixture

Caution:
Always make the adjustment from the lean side, i.e. if the mixture is too rich turn the idle-mixture-adjusting screw further to the left than necessary and then turn it to the right up to the setting required.

After every adjustment remove the adjusting wrench and accelerate the engine briefly, so that the air-intake system can cool off. Then wait until the indicator of the CO tester has stabilized. Never accelerate the engine with the wrench still in place as this could result in bending the control lever in the air-flow sensor.



- CO sampling point

The exhaust gas for the exhaust-gas test on vehicles with catalytic converter is sampled at the CO sampling pipe in the engine compartment.

For the CO measurement, remove plug (arrow) from measuring pipe. Separate metal probe from hose of exhaust-gas tester and plug hose directly onto CO sampling pipe.

20.3 Checking and setting values for idle:

- Conditions:

  Engine at normal operating temperature, oil temperature approx. +80°C. Switch on upper beam, switch off air conditioner.

  Disconnect crankcase ventilation hose from cylinder-head cover and seal off end of hose.

  Radiator fan must not operate when adjusting.

- Idle speed

  All versions: 850...1000 min^{-1}

- CO concentration: 0.3...1.2 vol. % CO

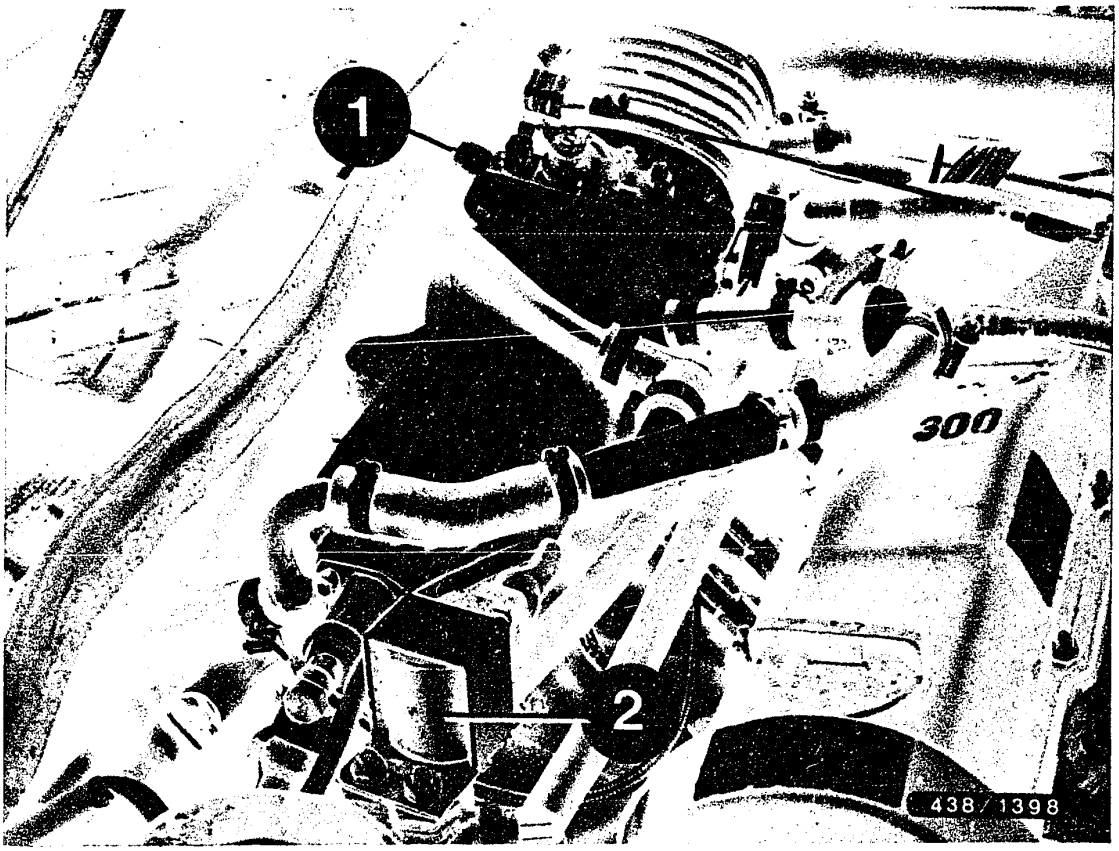
  with on/off ratio fluctuating

  checking value: 25...65 %

  setting value: 50 %

20.4 Final operations

Re-connect crankcase ventilation hose to cylinder-head cover.



1 = Idle-speed bypass screw
2 = Idle valve

20.5 As of 1985 model:

Idle valve for engine-speed increase

- Checking the idle valve
  Screw in idle-speed bypass screw until the engine speed drops below 700 min^{-1}.
  The valve must open and raise the engine speed.
  At above 1050 min^{-1} the valve closes.

- Checking the idle control unit
  At term. 87 ground connected to valve.
  Term. 31 = ground, term. 15 = vehicle electrical system voltage, term. 1 ignition pulses from ignition coil.

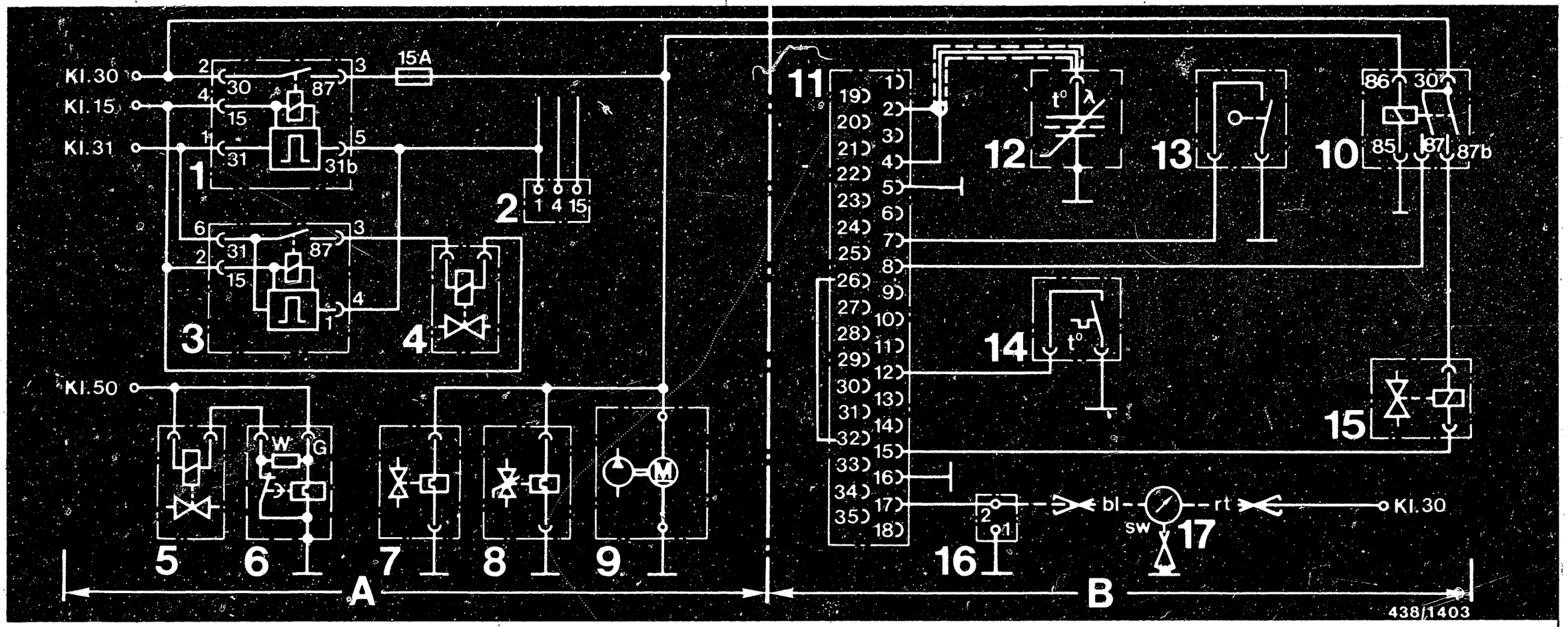
21. LAMBDA CLOSED-LOOP CONTROL

21.1 General information

The following section describes only the testing and repairing of the lambda closed-loop control. This work presupposes, therefore, that the actual K-Jetronic system is in good working order.
The sequence of the test chart Section 21.4 (starting on Coordinate J14) should be kept to.

The lambda closed-loop control in these vehicles has been expanded by the following functions as compared to the description in Technical Instruction VDT-U 3/1 En:

- A thermo-switch in the coolant system closes at engine temperatures below +25°C. In this condition, the control unit switches to "open-loop mode" with a fixed on/off ratio (t_3). The mixture is correspondingly enriched.
- The throttle-valve switch closes at full load and thus switches the control unit to the fixed on/off ratio (t_4) for mixture enrichment.
- An indicator lamp marked "OXS" in the instrument panel reminds the driver that it is time to replace the lambda sensor.



A = Safety circuit

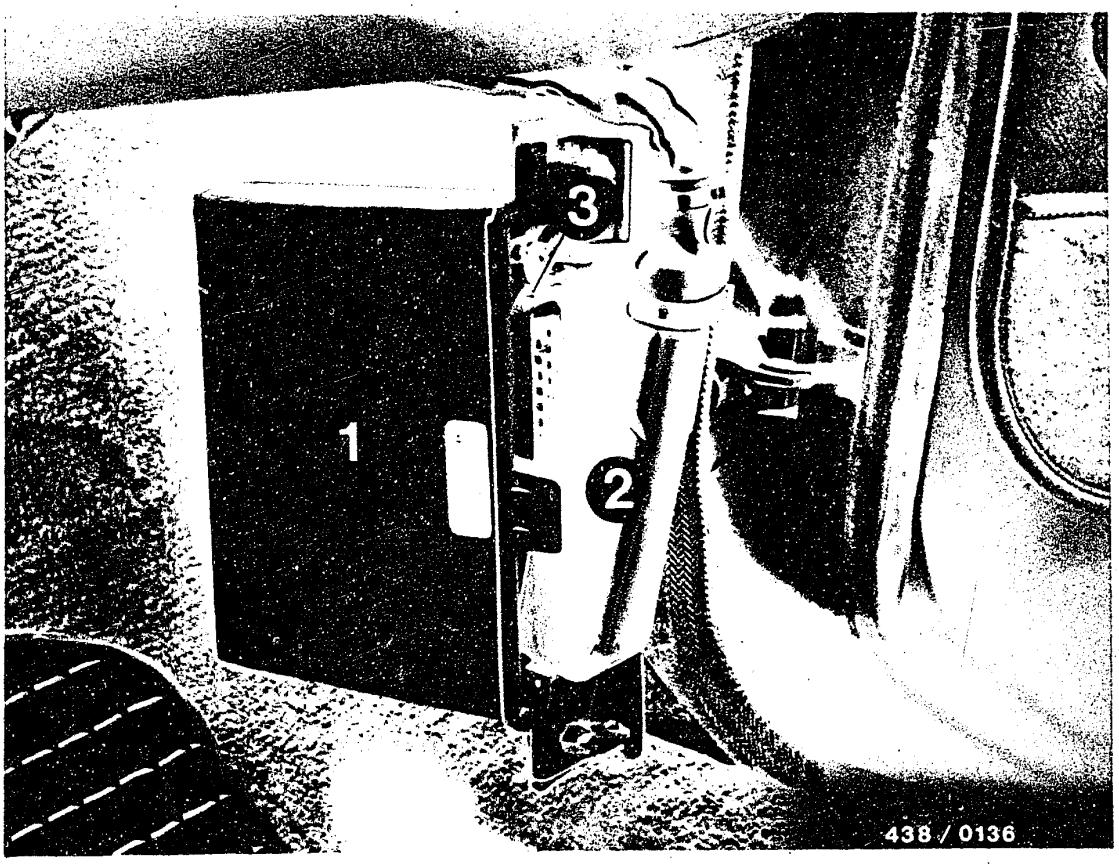
1 = Electronic relay
2 = Ignition coil
3 = Idle control unit
4 = Idle valve
5 = Start valve
6 = Thermo-time switch
7 = Warm-up regulator
8 = Auxiliary-air device
9 = Electric fuel pump

B = Lambda closed-loop control

10 = Main relay
11 = Control unit
12 = Lambda sensor
13 = Throttle-valve switch
14 = Thermo-switch +25°C
15 = Timing valve
16 = Test connection
17 = Lambda closed-loop tester KDJE-P600

bl = Blue
rt = Red
sw = Black

21.2 Electrical safety circuit with lambda closed-loop control, control unit 0 280 800 060/...061 with 35-pin plug connection



1 = Control unit
2 = Multiple plug
3 = Detent

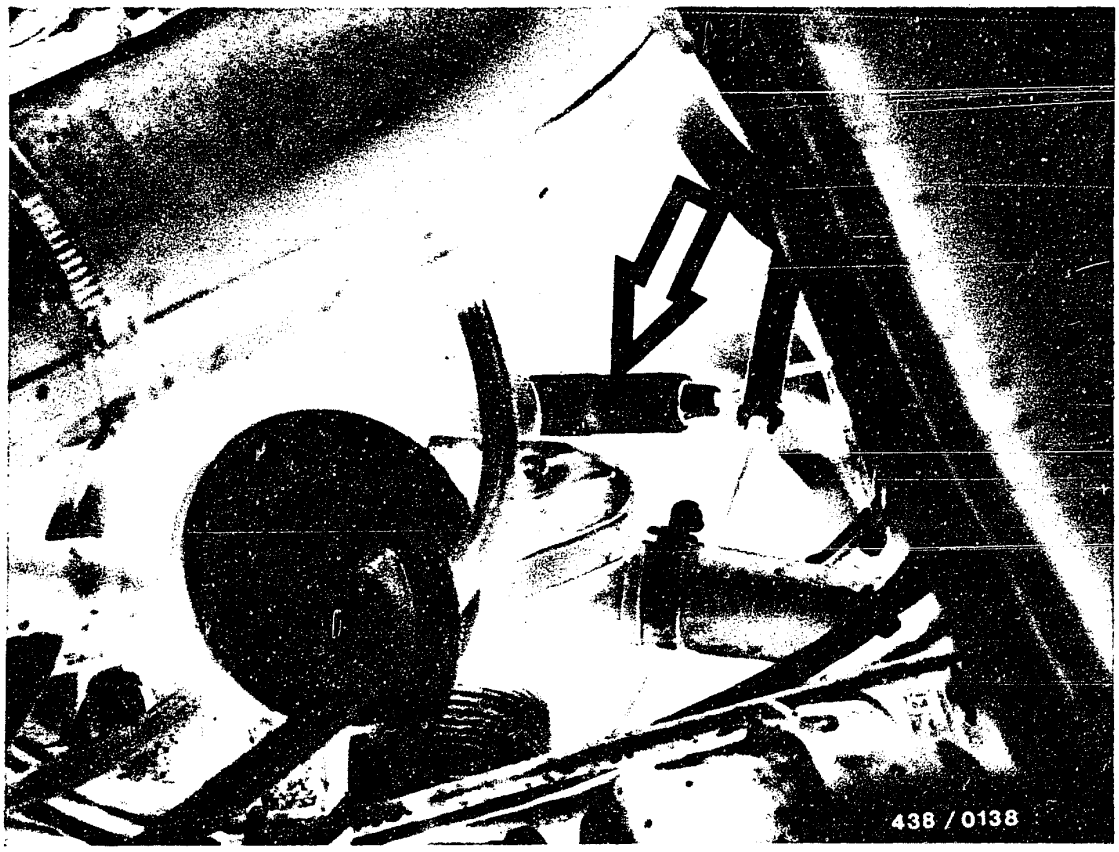
21.3 Installation position of individual components and additional information:

- The 35-pin control unit is mounted on the right-hand firewall under the glove compartment.

  Disconnect multiple plug from control unit:
  Press detent to the left and hinge multiple plug away from control unit.

1 = Electronic relay of safety circuit
2 = Main relay of lambda closed-loop control

- The main relay of the lambda closed-loop control is in the central-electrics box on the left-hand side under the instrument panel.

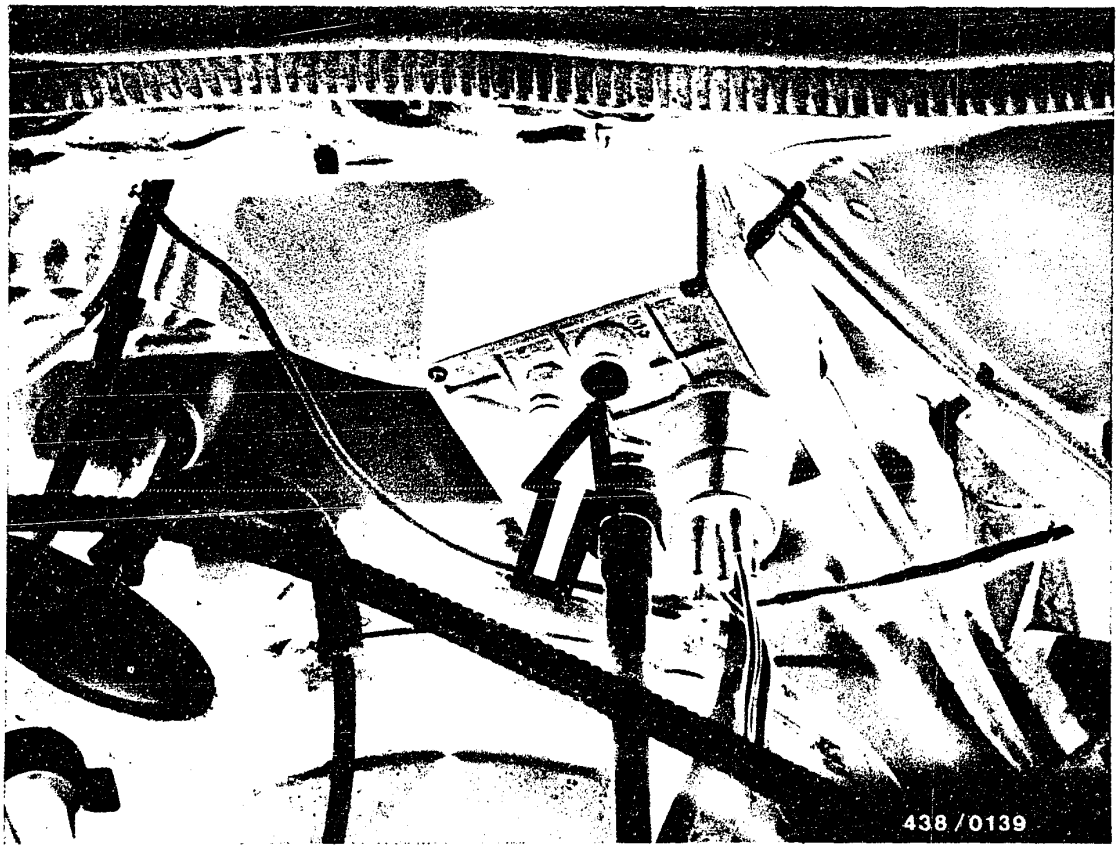


- Lambda sensor

The lambda sensor (arrow) is screwed into the exhaust manifold.
The lambda probe is screwed into the front of the exhaust pipe (arrow) in the engine compartment.
In order for the lambda probe to operate properly, the exhaust system must be absolutely leak-tight in the area of the elbow, probe and pipe.
Leak test:
Pressurize the exhaust system using compressed air and check for leaks using soapy water or leak detector spray (e.g. Guepoflex) at all fittings and connections.

Caution:
Never use combustible fluids to perform leak tests.

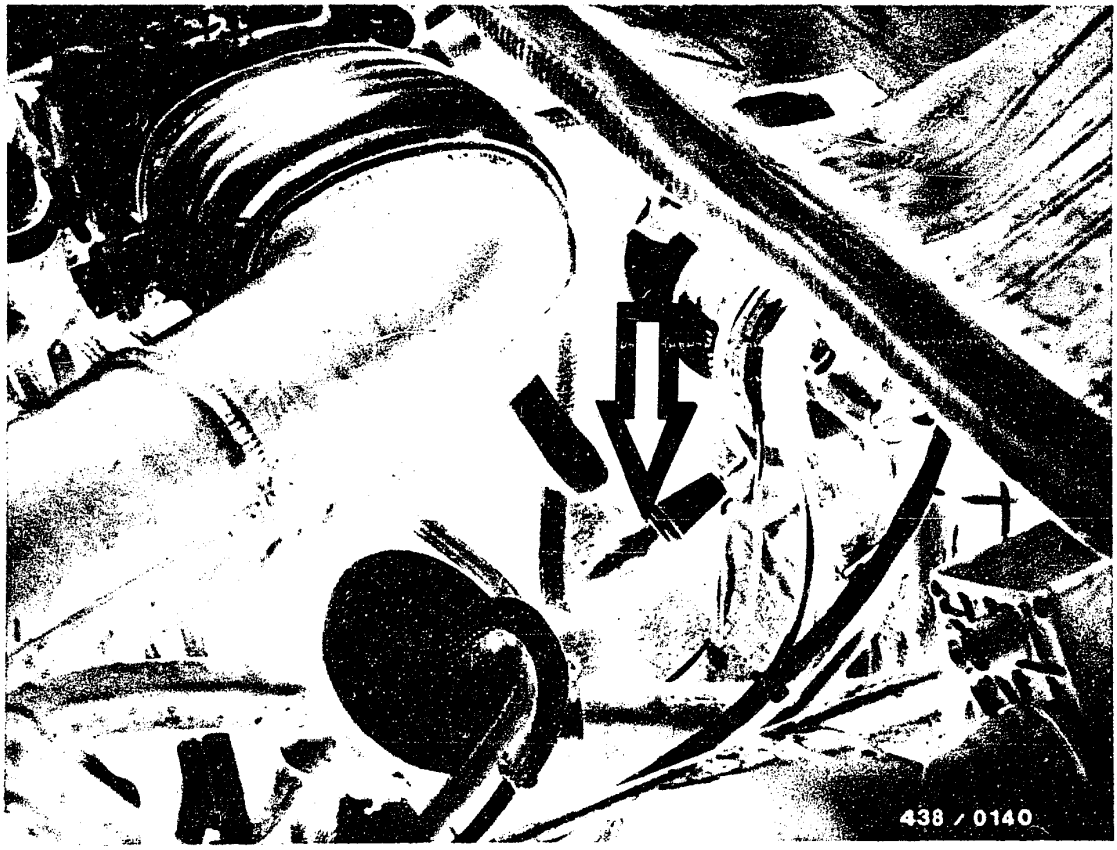
If the probe is replaced, apply special mounting paste VS 14016 Ft (5 964 080 105) to the threads of the new probe. Make sure that paste is applied only to the threads and does not get into the slots in the protective sleeve.



- Counter switch

The lambda sensor should be replaced every 50 000 km (30 000 miles). At this mileage the indicator lamp marked "OXS" in the instrument panel lights up.

After the lambda sensor has been replaced, the knob on the counter switch (positioned in front of water box - arrow) must be pressed in again.

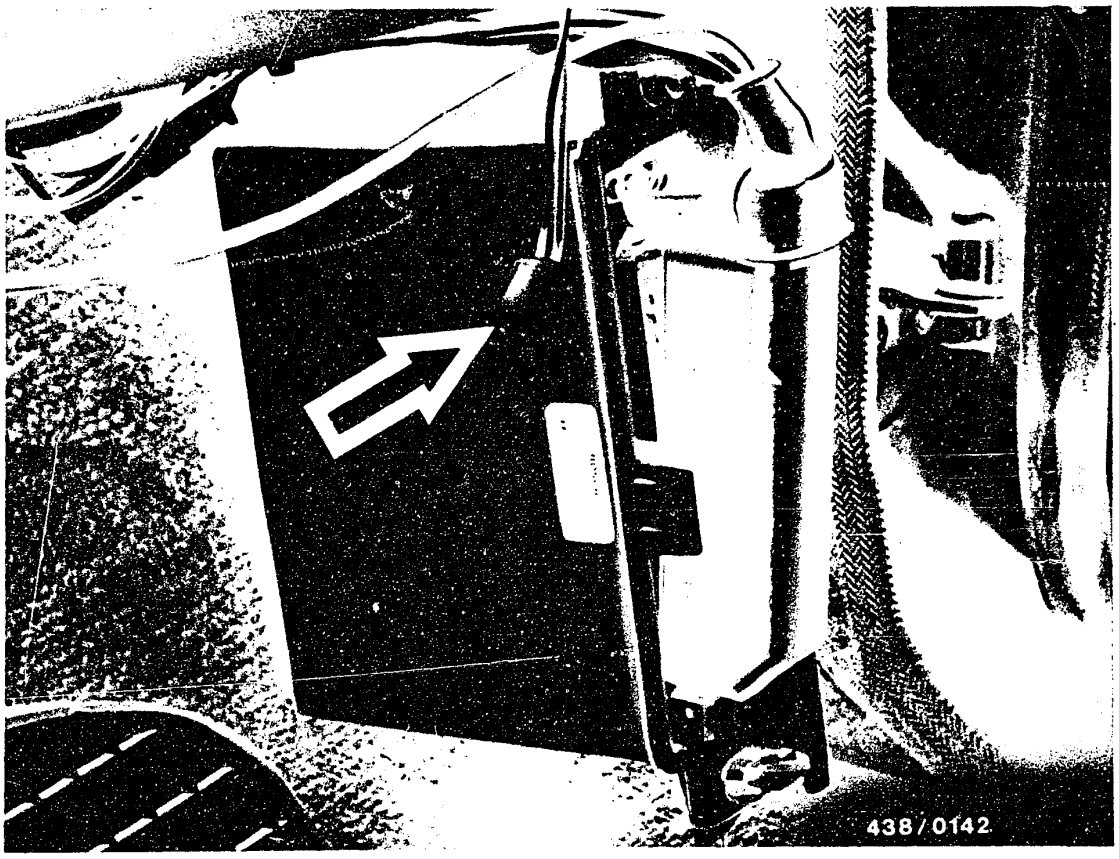


- Probe lead connector

Clean the connector (arrow) if necessary before unplugging. When reconnecting, keep dirt out of the connector internals and make sure that the two connector halves snap together.

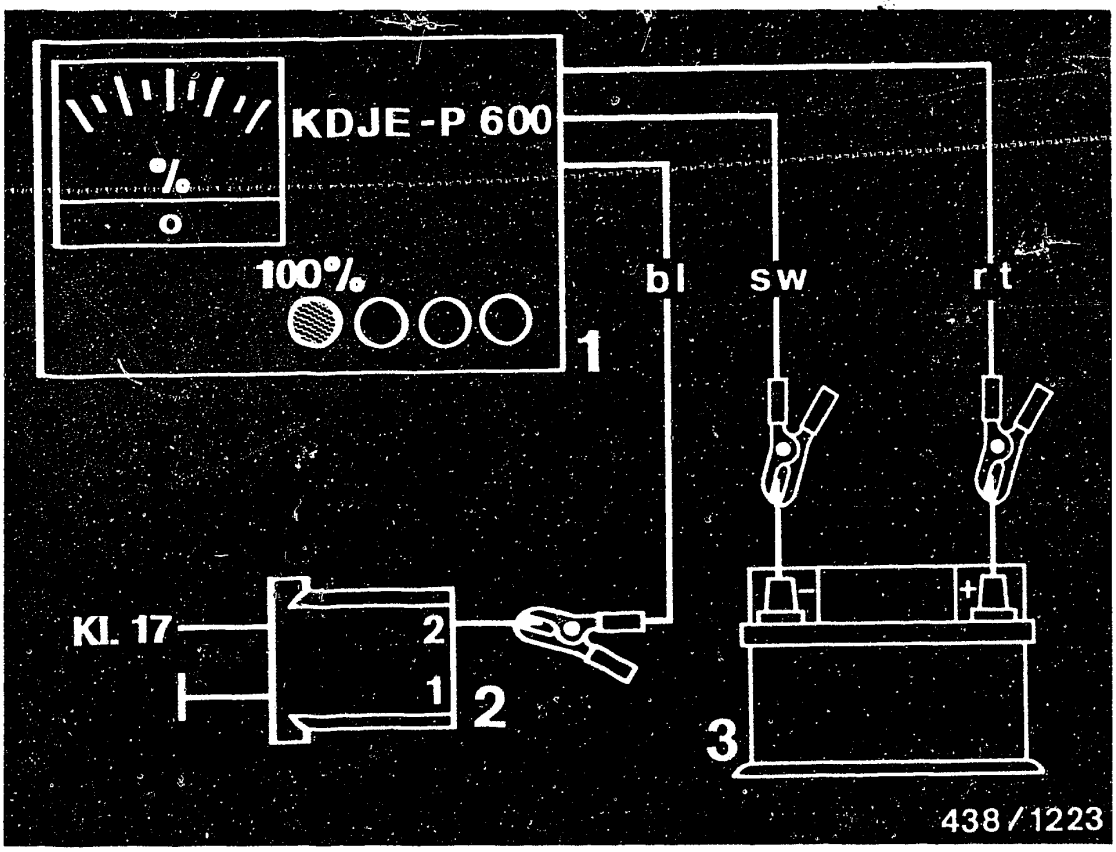
- Timing valve

The timing valve (arrow) is next to the fuel distributor.



- Test connection

The test connection (arrow) for the lambda closed-loop tester KDJE-P-600 is on the wiring harness, near the control unit.

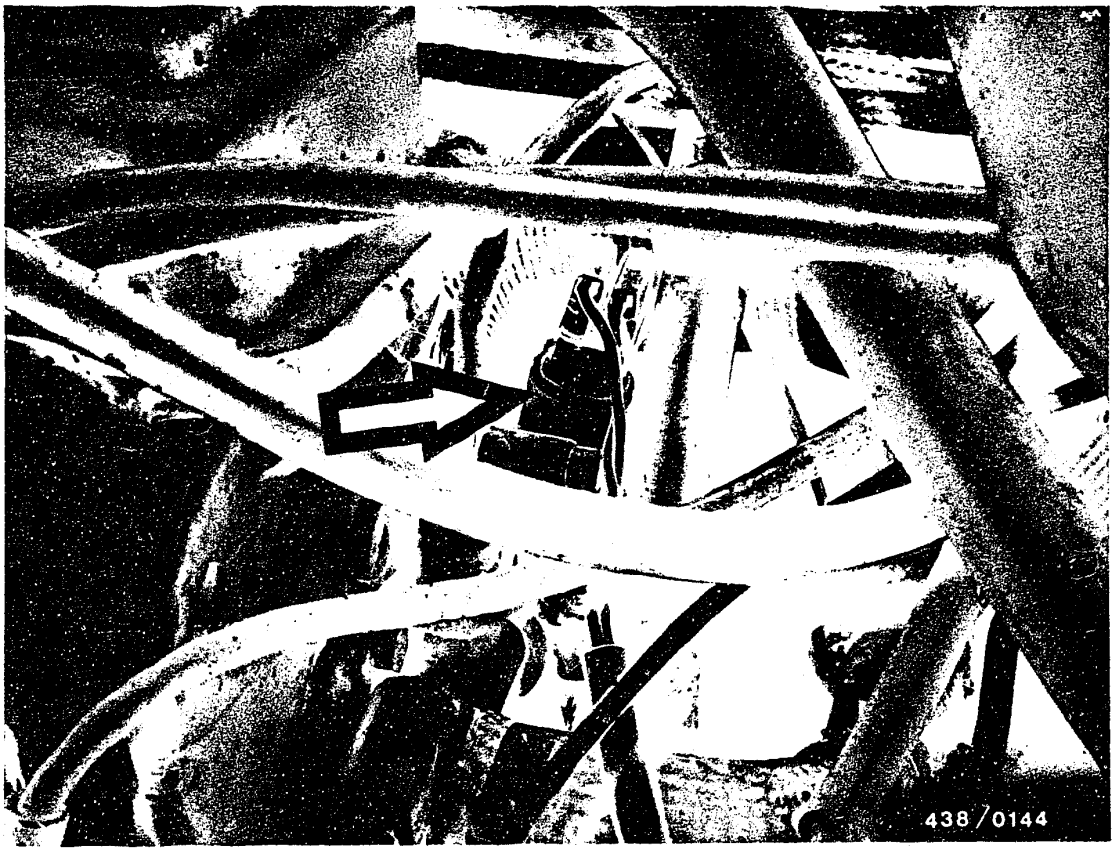


1 = Lambda closed-loop tester
2 = Test connection
3 = Battery
bl = Blue
rt = Red
sw = Black

- Connecting lambda closed-loop tester KDJE-P 600:

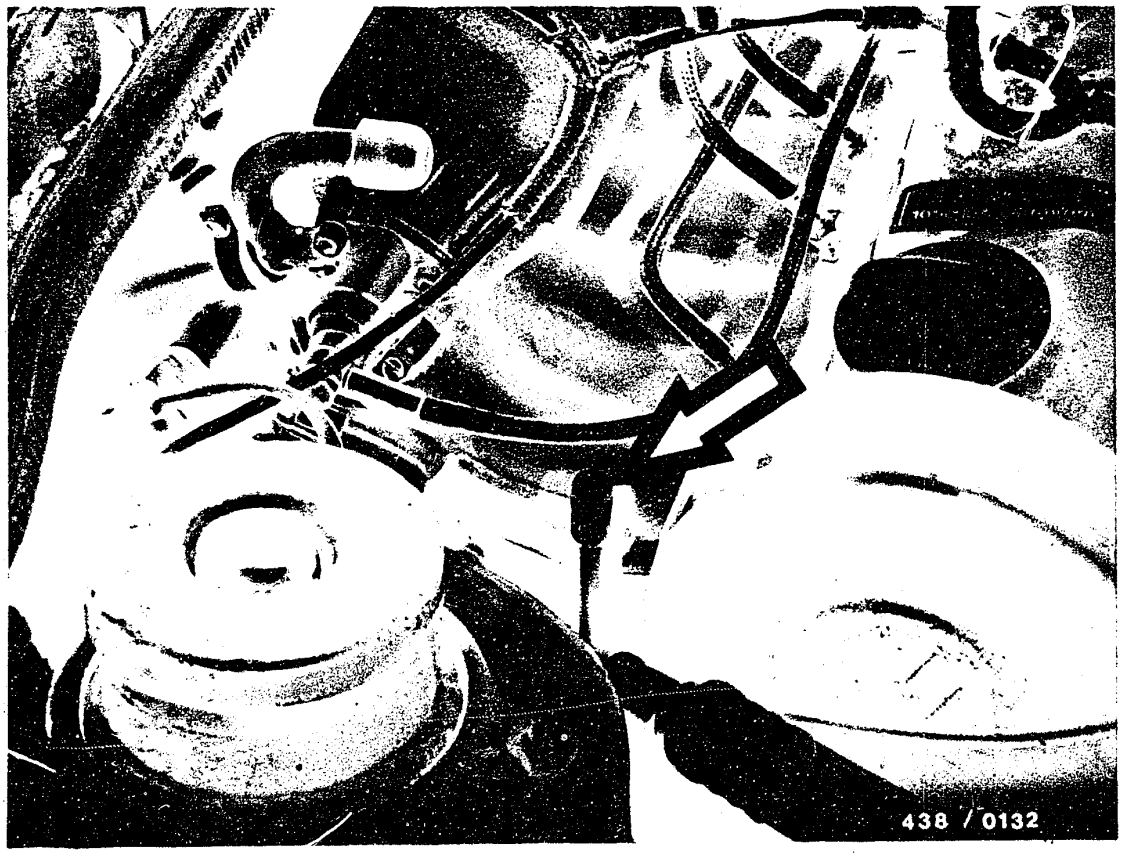
The tester is connected using the three-core universal test lead which comes with the tester.
Attach the plus (red) and minus (black) clips directly to the battery.
Attach the blue test clip to contact 2 of the test connection using a wire jumper.

Depress the left-hand pushbutton and read the measurement on the 100% scale.



- Thermostatic switch

The thermostatic switch (arrow) is installed in the cooling system.



- CO sampling pipe

The exhaust gas for the exhaust-gas test on vehicles with catalytic converter is sampled at the CO sampling pipe in the engine compartment.

For the CO measurement, remove plug (arrow) from measuring pipe. Separate metal probe from the hose of the exhaust-gas analyzer and plug hose directly onto CO sampling pipe.

21.4 Test and troubleshooting chart for K-Jetronic lambda closed-loop control

Note:
These procedures can only be carried out if the thermo-time switch (25°C switch) is operating properly.

For this reason, first remove and check the thermostatic switch. Catch any escaping coolant for reuse.

Switching point: 25 ± 5°C.

At temperatures which exceed this value the switch must be open; the switch must be closed at temperatures below this value. (Cool down the switch by placing it in a freezer, or warm it up in a water bath if necessary.)

- Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
  Control unit 0 280 800 030/037 with 35-pin connector

Run engine up to temperature and turn off. Allow hot motor to cool for approx. 3 min. Connect lambda closed-loop tester KDJE-P 600.

yes

Bridge safety circuit. Operation of stepping valve can be heard and felt.

yes

Check jumper in multi-contact plug between terminals 26 and 32. O.K.?

yes

Continued at J17/J18

no

Check voltage at terminals 30 and 86, as well the ground connection of the lambda relay at terminal 85. O.K.?

yes

Check voltage at terminals 87 and 87b. O.K.?

no

Defective lambda relay.

yes

Check voltage at terminal 8 as well as ground connections at terminals 5 and 16 of the control unit. O.K.?

yes

Check stepping valve: winding resistance 2...3Ω

no

Electrically defective stepping valve.

yes

Check voltage at line connector: One contact must show battery voltage when connected to ground. The other contact must be connected to terminal 15 of the control unit.

yes

Defective control unit.

- Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models)
  Control unit 0 280 800 060/061 with 35-pin connector (continued)

Disconnect lead from thermostatic switch. Tester display: repetition rate t_1. (Control unit in open-loop mode; wait several seconds before reading static display).
t_1 = 45 ... 55%

no

Tester display deviates from 45 ... 55%.

yes

Make sure tester is connected correctly and display indicates %. Repetition rate now O.K.?

no

Take sensor lead apart: On/off ratio moves to 45 ... 55%

yes

Sensor defective

No reading

yes

Check lead between control unit term. 17 and test connection contact 2 (bottom picture) for continuity.

yes

Disconnect probe lead at plug. Repetition rate remains t_1. Connect probe lead to vehicle ground on control unit side: repetition rate increases to t_2 (control unit switches to "rich mixture stop").
t_2 = at least 87%

no

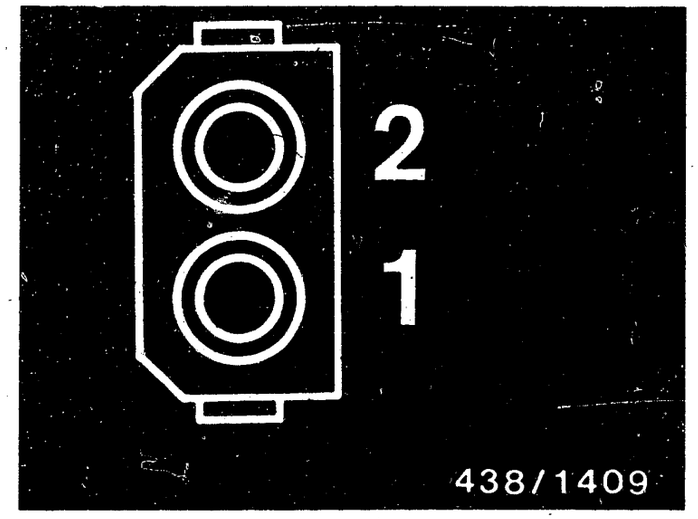
Check lead from terminal 2 of control unit to probe for continuity. O.K.?

yes

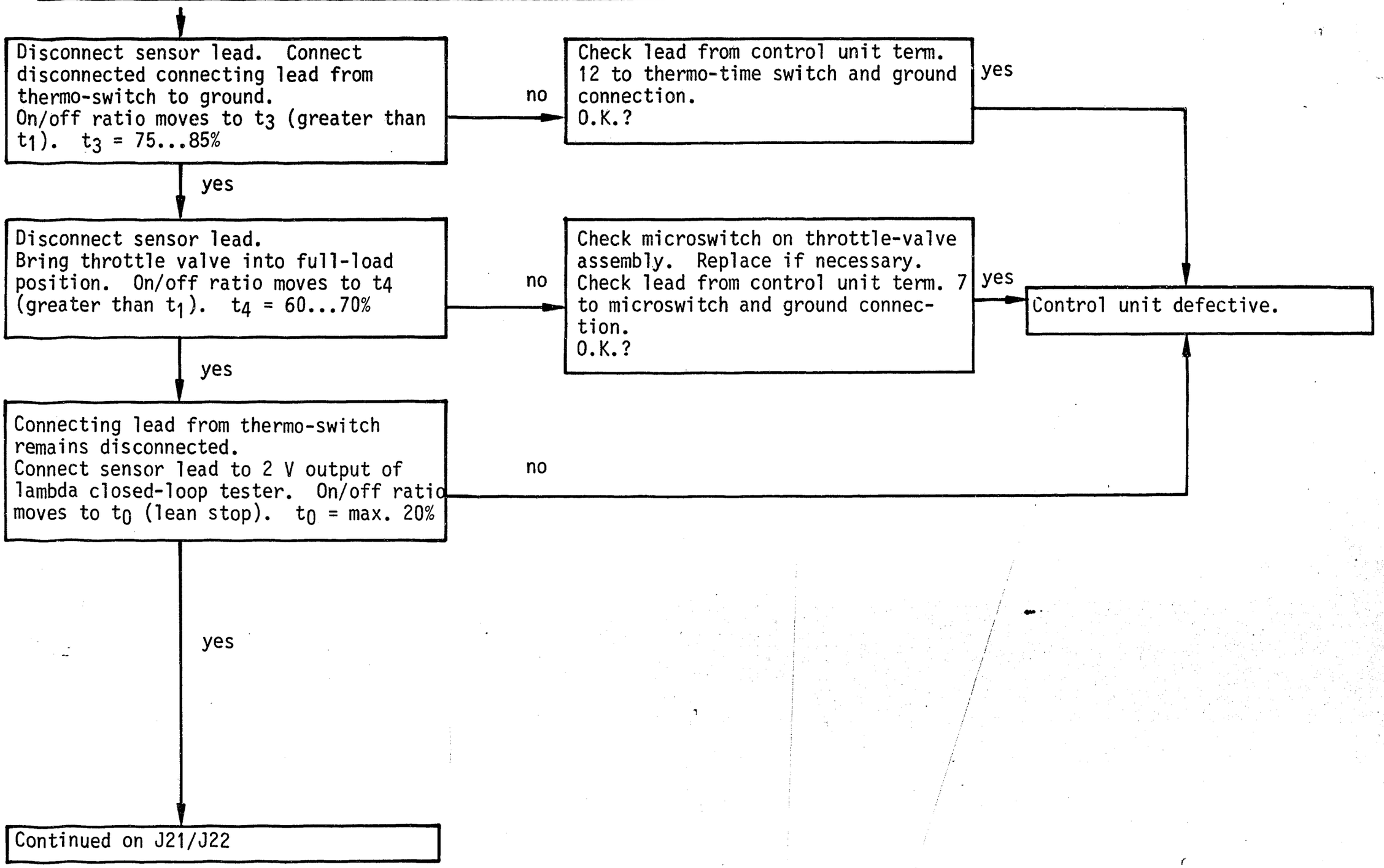
Defective control unit.

yes

Continued at J19/J20



- Testing and trouble-shooting chart for lambda closed-loop control on K-Jetronic system
  Control unit 0 280 800 060/061 with 35-pin plug connection (continued)



- Test and troubleshooting chart for K-Jetronic lambda closed-loop control (USA models) Control unit 0 280 800 060/061 with 35-pin connector (continued)

yes

Connect lead to thermostatic switch; probe lead remains disconnected.
Connect exhaust gas tester. Again bring engine up to operating temperature.

yes

Adjust CO concentration* with idle-mixture-adjusting screw and adjust idle speed at throttle-valve assembly.
CO concentration:
0.3 ... 1.2 vol. %

Idle speed:
All versions
850 ... 1000 min^{-1}

yes

Connect probe lead.
CO value now max. 1.0% by volume.

no

Increase speed to approx. 1500 min^{-1}
CO value now 1.0% by volume.

yes

Check for exhaust system leaks (upstream of catalytic converter) or at probe seal, and correct.

no

Disconnect probe lead.
Connect lead to ground on control unit side:
CO value increases.

yes

Defective probe.

no

Hydraulically defective stepping valve.

* To adjust CO value, remove and close off crankcase breather tube on cylinder head. Also remove hose from activated charcoal filter/activated charcoal container.

After-sales Service

Technical Bulletin

Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10. 1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

Technical Bulletin

EXCHANGEABLE NON-RETURN VALVES
in electric fuel pumps 0 580 254

VDT-I-438/104 En
3.1984
(Replaces Ed. 3.1983)

Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal
0 580 254 001	1 587 010 500	---	---
003	502	---	---
005	502	---	---
007	500	---	---
008	508	---	---
010	508	---	---
011	002	---	---
941	002	---	---
942	002	---	---
945	006	---	---
947	002	---	---
948	005	---	---
949	002	---	---
950	006	---	---
952	002	---	---
953	501	---	---
954	002	---	---
956	002	---	---
957	002	---	---
959	002	---	---
960	002	---	---
961	002	---	---
963	005	---	---
964	002	---	---
965	002	---	---
967	002	---	---
968	002	---	---
970	002	---	---
972	002	---	---

Electric fuel pump	Parts set (non-ret. valve and seal ring)	Non-return valve	Seal
0 580 254 973	1 587 010 002		
975	003[4]		
976	004[3]		
978	1 587 410 901		
979	010 004[3]		
980	002		
982[1]	003[4]		
982[2]	1 587 410 901		
984	010 004[3]		
985	---	1 583 385 006	1 580 203 002
986	---	386 011	001
987	---	008	001
988	---	008	001
989	---	008	001
990	---	385 004	002
991	---	004	002
992	1 587 010 001	---	---
996		386 001	001
998		385 004	002
9 580 233 014	508	---	---
234 003	002	---	---
005	002	---	---

[1] = up to FD 822 [2] = as from FD 823

[3] = parts set ..003 can also be used (delivery-line connection at 90°)

[4] = parts set ..004 can also be used (delivery-line connection axial)

Please direct questions and comments concerning the contents to our authorized representative in your country.

After-sales Service

Technical Bulletin

HOT-STARTING PROBLEMS

438

VDT-I-438/105 En
3.1980
Replaces Ed. 2.1980

K-Jetronic

Hot-starting problems can occur in various vehicles fitted with K-Jetronic. This means that when an engine is switched off whilst still hot and then switched on again after a short period, it does not start as well as it should.

The engine, the ignition system and the K-Jetronic system in these vehicles should be carefully checked. With the K-Jetronic particular attention should be paid to the:

complete system (in case of leaks),
injection valves (in case of leaks),
correct position of the air-flow sensor plate (rest position)..

Instructions can be found in the vehicle-related repair manuals VDT-W-438/5.. .

If the engine still does not start satisfactorily when hot, even after checking, a timing relay can be fitted in K-Jetronic systems which are not equipped with a solenoid valve for reducing the control pressure as additional starting help.

Timing relay 0 340 000 003 controls the start valve during hot starts. The start valve then injects extra fuel intermittently (sometimes cutting out completely.

The timing valve is fitted according to the wiring diagram (see reverse side). The fitting of this relay will be charged for.

After fitting the timing relay starting should be carried out as follows:

Vehicles with start valve in intake manifold - with open throttle valve,
Vehicles with start valve in idle duct - with closed throttle valve.

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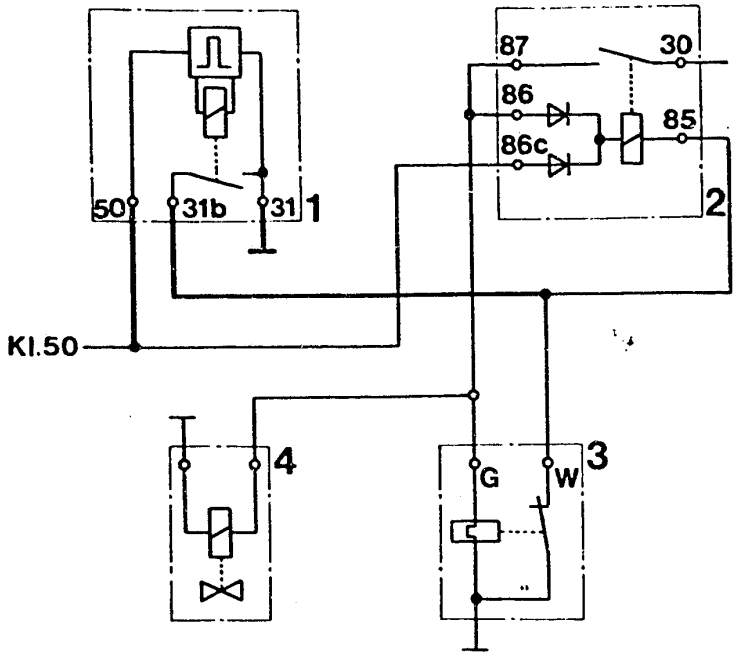
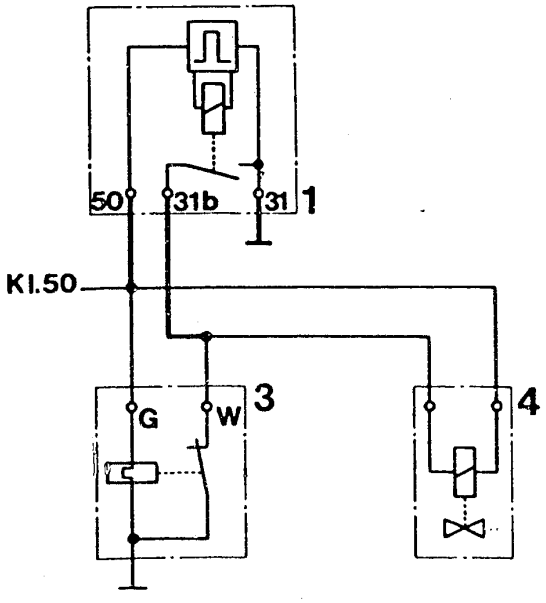


K-Jetronic system with post-injection relay

1 = Timing relay 0 340 000 003
2 = Post-injection relay
3 = Thermo-time switch
4 = Start valve



K-Jetronic system without post-injection relay

After-sales Service

Technical Bulletin

O-RING FOR K-JETRONIC INJECTION VALVES
0 437 502

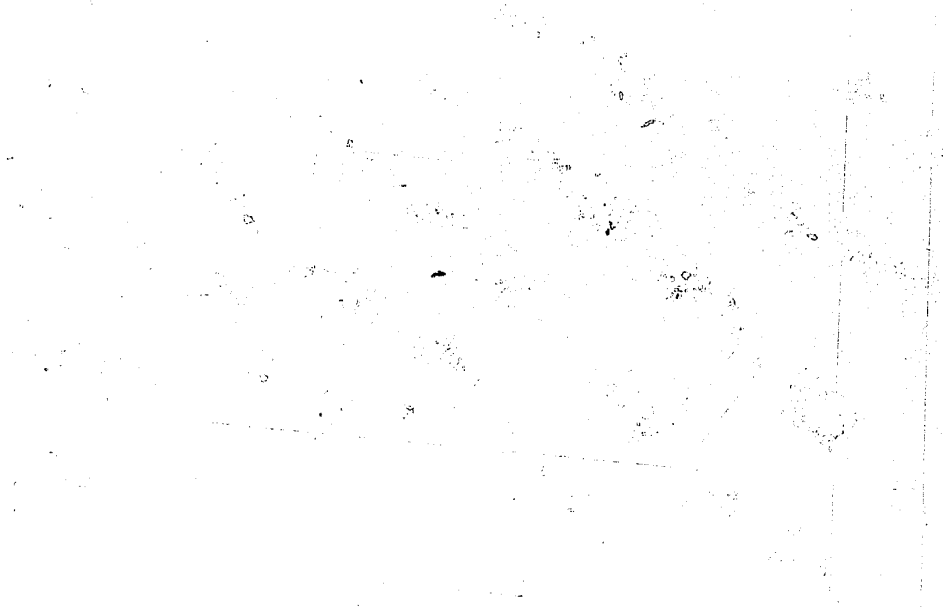
VDT-I-438/108 En
7.1982

For K-Jetronic injection valves with O-ring seals the O-ring is available as a service part under Part No.: 3 430 210 600.

This O-ring is also listed on service-part microfiche EE...* together with other Jetronic service parts.

* See microfiche EE00 under 0 280 ..

Since the O-rings are exposed to extreme temperatures, they should be replaced whenever service work is performed.
"Unmetered air" which is drawn in through leaky injection valve seals is a frequent cause of trouble.



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After-sales Service

Motor Vehicle Service Information

EXPORT VEHICLES WITH
EMISSION CONTROL SYSTEMS

VDT-I-Gen. 042 En.
12. 1981

K-Jetronic and L-Jetronic

Export vehicles for countries with stringent exhaust emission regulations are equipped with various emission control systems. To meet the legal requirements*, these systems are installed either individually or in combination, depending on the model version.

Emission control system	installed predominantly in export vehicles				
	Sweden	Australia	Canada	USA	Japan
Exhaust-gas recirculation*	●	●	●	(●)	(●)
Secondary-air induction*	●	●	●	(●)	(●)
Secondary-air injection*	●	●	●	(●)	(●)
Catalytic converter*	-	-	-	●	●
Lambda closed-loop control	-	-	-	●	●

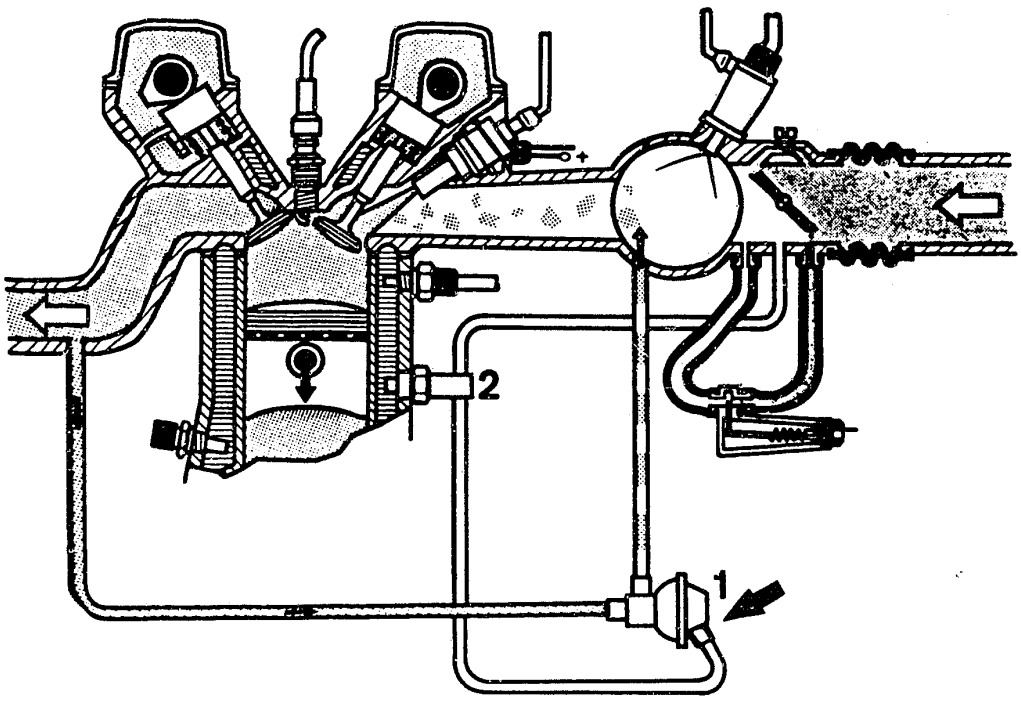
The vehicle-related After-Sales Service Instruction Manuals for the K-Jetronic and L-Jetronic describe the construction, function and operating principle of the emission control systems. The influence of these systems should be borne in mind particularly when adjusting the idle speed and CO concentration.

Export vehicles are sometimes also encountered in countries which do not have particularly stringent exhaust emission legislation. This Service Information publication summarizes the various emission control systems and provides information for the After-Sales Service in countries with exhaust emission legislation which does not require such emission control systems or unleaded fuel.

* Not made by Bosch

BOSCH Geschäftsbereich KH Kundendienst. Kfz-Ausrüstung

1. Exhaust-gas recirculation (EGR)



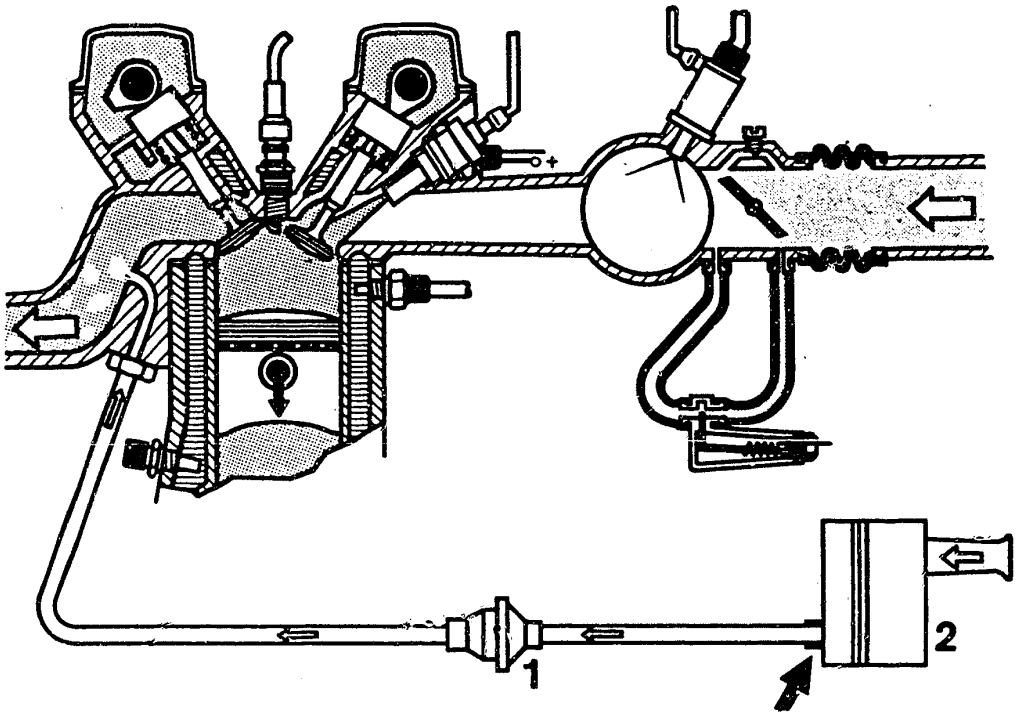
1 = Exhaust-gas recirculation valve 2 = Thermo-valve

Some of the exhaust gas is returned to the intake manifold via a vacuum-controlled exhaust-gas recirculation valve. This recirculation of exhaust gas into the combustion chamber lowers the combustion temperature and reduces the emission of nitrogen oxides (NOx). The thermo-valve and the position of the vacuum tapping port on the throttle-valve assembly ensure that exhaust gas is only recirculated when the engine is warm and only at part load. There is a reduction in engine speed of about 200 min^{-1}. Exhaust-gas recirculation is inoperative at idle, full-load and when the engine is cold.

When testing or adjusting the idle speed and CO concentration, remove and seal off the vacuum control line (arrow) on the exhaust-gas recirculation valve in order to ensure that the exhaust-gas recirculation system is inoperative.

In countries without stringent exhaust emission legislation it is not necessary to shut down the system.

2. Secondary-air induction (e.g, Volvo Pulsair system)



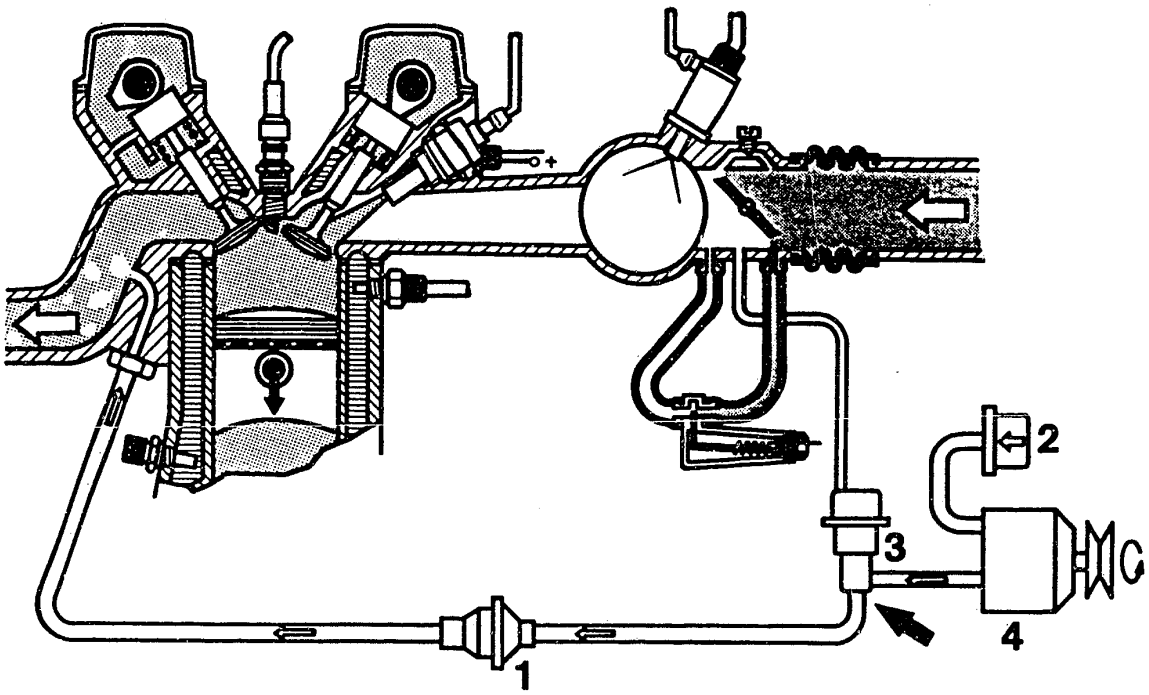
1 = Non-return valve 2 = Air filter

The pulsating alternation between overpressure and depression in the flow of exhaust gas inducts fresh air into the exhaust ports via a non-return valve. Unburned residues of carbon monoxide (CO) and hydrocarbons (HC) are partially after-burned, leading to fewer pollutants in the exhaust gas.

When testing or adjusting the idle speed and the CO concentration, the secondary-air induction system must be rendered inoperative. To do this, remove the hose between the non-return valve and the air filter on the air filter (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air induction system.

3. Secondary-air injection



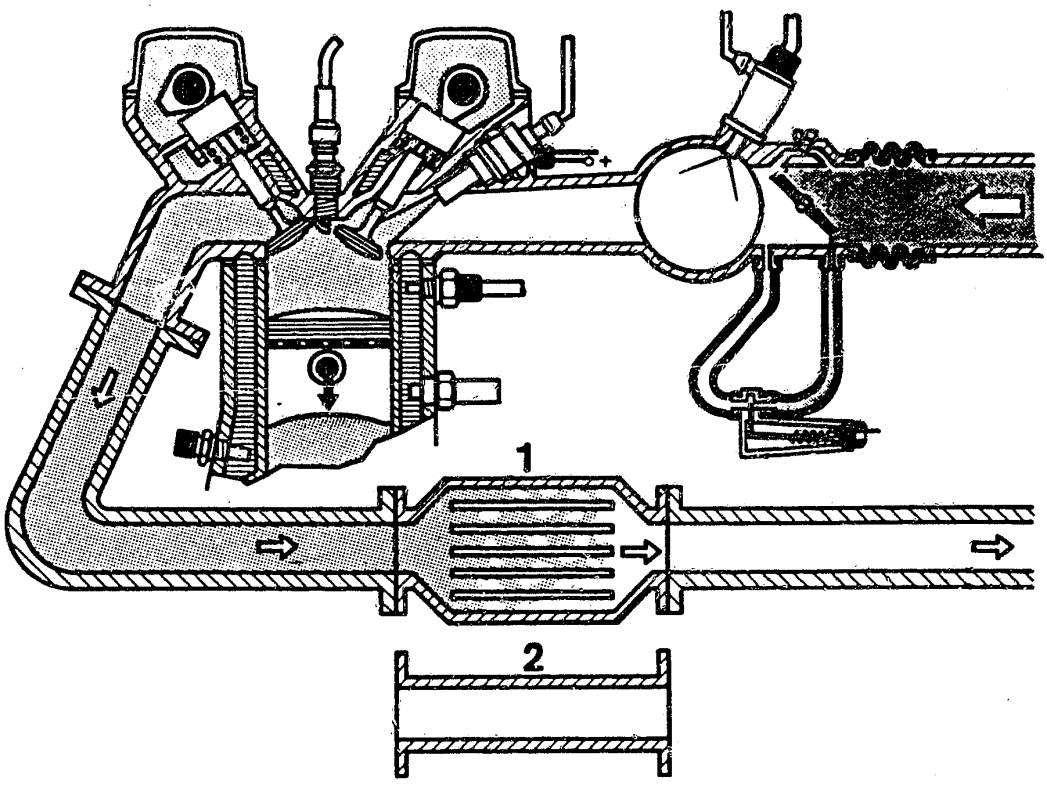
1 = Non-return valve
2 = Air filter
3 = Change-over valve
4 = Air pump

An air pump driven by the engine inducts fresh air through the air filter and forces it via a non-return valve into the exhaust ports. As in the case of secondary-air induction, there is a partial after-burning of the CO and HC residues. This makes the exhaust gas cleaner. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system.

When testing or adjusting the idle speed and the CO concentration, shut down the secondary-air injection system. To do this, remove the hose from the outlet of the change-over valve (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air injection system.

4. Catalytic converter



1 = Catalytic converter 2 = Intermediate pipe

The single-bed catalyst installed in the exhaust system in export vehicles (also with lambda closed-loop control) reduces all three pollutants CO, HC and NOx to a minimum. The catalytic surface triggers chemical reactions of the pollutants, rendering them non-toxic.
Important: Proper operation only possible in conjunction with unleaded fuel (at present only in USA and Japan).

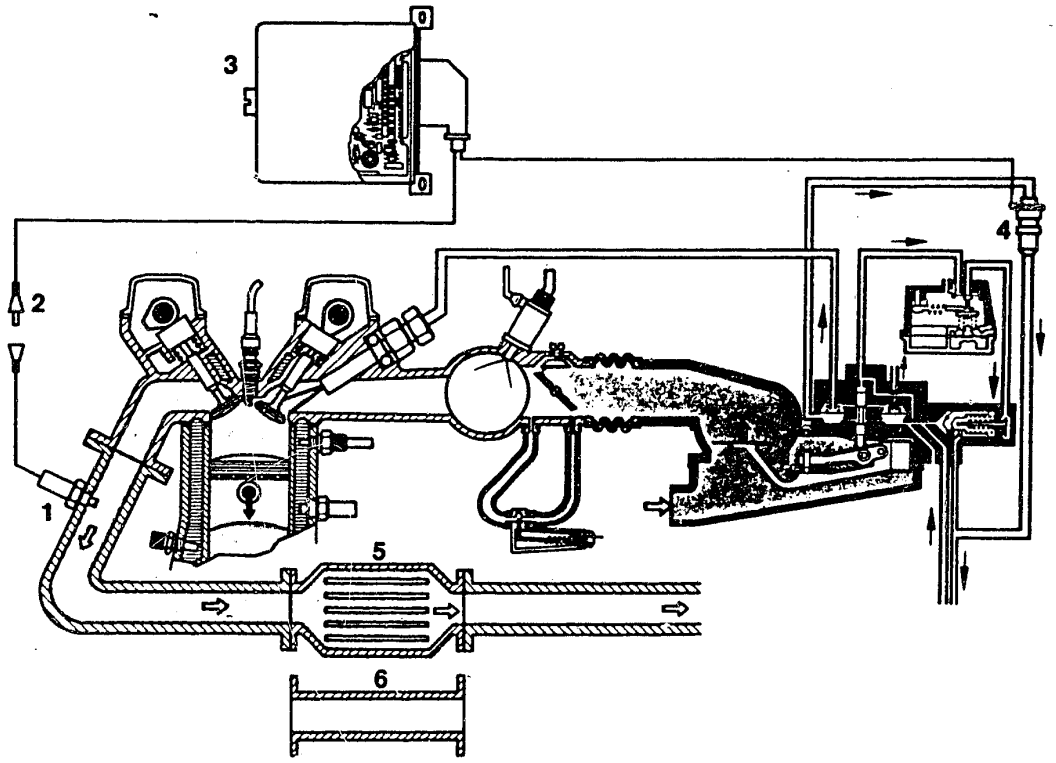
When testing or adjusting the idle speed and the CO concentration, the catalytic converter can be neglected since the exhaust-measuring point is upstream of the catalyst.

Caution!

If the vehicle is operated on leaded fuel (predominantly in countries without stringent exhaust emission legislation) the catalytic converter must be removed. If not removed, the catalytic converter would become clogged up and lead to a reduction in the power output of the engine.

Appropriate intermediate pipes for converting the exhaust system are available from the vehicle manufacturer.

5. Lambda closed-loop control



1 = Lambda sensor
2 = Plug
3 = Control unit
4 = Timing valve
5 = Catalytic converter
6 = Intermediate pipe

Export vehicles for the USA and Japan are equipped with lambda closed-loop control. This additional function of the K-Jetronic or L-Jetronic is not a downstream emission control system, but ensures a low pollutant content in the exhaust gas by means of optimum mixture preparation. Additional exhaust-gas recirculation, secondary-air induction or secondary-air injection is therefore not necessary in most cases. Like the catalytic converter, the lambda sensor (in the exhaust gas) operates only with unleaded fuel.
If the vehicle is operated on leaded fuel, the lambda sensor becomes clogged up and ceases to operate. The control unit detects this and switches from closed-loop to open-loop control. The system then operates on a fixed air-fuel ratio in the same manner as a K-Jetronic or L-Jetronic without lambda-closed-loop control. Before operating on leaded fuel, the lambda sensor should be removed and the installation hole should be closed off with a screw plug M18x1.5 (length of thread max. 8.5 mm). The disconnected plug (2) of the sensor connecting cable should be insulated and fastened to a suitable place on the vehicle body.

Caution!
Under no circumstances must the control unit or the timing valve be shut down on the lambda closed-loop control of the K-Jetronic.
The catalytic converter should be replaced by an intermediate pipe.

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After-sales Service

Motor Vehicle Service Information

HOT-STARTING PROBLEMS

on vehicles fitted with Jetronic

VDT-I-Gen. 050 En
9.1982

Customer complaints

If the vehicle is parked and the engine switched off after having been run at normal operating temperature, it often occurs that the engine proves difficult to start, or won't start at all, and when it does start it runs extremely roughly (only on 2 or 3 cylinders). The engine has to be accelerated a number of times before it runs smoothly.

Causes

For economic reasons ("stretching" of the mineral-oil reserves), it can happen that alcohol in varying quantities has been added to gasoline. Methanol is used for instance.
Such alcohol-added fuels, depending upon the amount of alcohol, adversely affect the hot-starting characteristics of the engine. The addition of alcohol raises the vapor pressure of the fuel and the result is that the boiling point of the alcohol-fuel mixture drops. This in turn leads to the formation of fuel-vapor locks in the fuel system when the engine has been switched off.

This means that when starting, and during the subsequent idle period, the air-fuel mixture is temporarily too lean.

Remedies

- Check the ignition and Jetronic systems, particularly for leaks.
- Changing to another brand of gasoline can sometimes cure the problem immediately.
- In many cases, fully depressing the gas pedal helps during starting, as does slightly depressing the gas pedal during the idle period until the engine runs smoothly.
- Fit the pulse relay 0 340 000 003 (refer also to VDT-I-438/105) in vehicles with K and D-Jetronic.
  This step, though, will still not fully alleviate the rough running of the engine during the starting off phase

Note:

The pulse relay 0 340 000 003 is NOT to be installed in vehicles fitted with L-Jetronic.

Please direct questions and comments concerning the contents to our authorized representative in your country.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrustung

COLD-START, WARM-UP AND ACCELERATION PROBLEMS in Jetronic-equipped vehicles

VDT-I-Gen. 051 En
10.1984
(Supersedes Ed. 10. 82)

Customer complaint

- Starting problems with cold engine
- Engine bucking during warm-up
- Rough idle (fluctuations in engine speed)
- Engine miss during acceleration (flat spot)
- Loss of power

Cause

If the ignition and the Jetronic have been checked, and the test specifications are being reached, coking of the intake valves might be the cause of the problems sited.

Oil carbon, with its sponge effect, delays the continuous movement of the fuel from the fuel-injection valve to the combustion chamber.

As a result, the air-fuel mixture sometimes becomes so lean that it is no longer certain to ignite.

The loss in power is due to a reduction of the cylinder charge, and is the result of extremely serious coking.

Complex relationships between properties specific to the engine, the engine oil used, and fuels, as well as the driving cycles can produce such coking on the intake valves.

Checking

If coking is suspected, we recommend checking the intake valves using an endoscope or a motoscope. Deposits on the valve head and/or shaft can be seen with these instruments and evaluated.

Corrective measures

Take out the coked intake valves and remove the deposits mechanically.

Additives

There are no reliable results yet available on the effectiveness of cleaning additives or fuel additives. The use of fuel additives can cause deposits in the fuel system and damage certain plastics and seals.

Please direct questions and comments concerning the contents to our authorized representative in your country.

After-sales Service

Motor Vehicle Service Information

LIQUID PETROLEUM GAS (AUTOGAS) SYSTEMS AND VEHICLES WITH K-JETRONIC

VDT-I-Gen. 052 En
10.1982

Fitting at a later stage

Vehicles with K or L-Jetronic are not suitable for fitting at a later stage with liquid petroleum gas (LPG) systems.

Numerous problems can occur, such as:

- Reduction of fuel flow through the injection valves due to deposits
- Stiffness or blocking of the K-Jetronic fuel distributor plunger (due to gumming or similar) in the course of time with "gas only operation."
- Increased danger of backfiring in the intake manifold (burbling) and thereby damage to the air-flow sensor.

Guarantee

Guarantee claims for failed Jetronic components from vehicles thus converted will not be accepted.

Conversion to liquid gas operation is made at the risk of the vehicle owner.

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After-sales Service

Motor Vehicle Service Information

Electrical Equipment

VDT-I-Gen. 060 En

10.1983

FITTING POSITION AND MARKING OF
AIR-FLOW SENSOR PLATE 3 430 100 ..

In air-flow sensors for
K and KE-Jetronic

General information/fitting position

As a result of the stamping process during manufacturing, air-flow sensor plates have a sharp and a slightly rounded edge around the circumference. The sharp edge serves for measuring the air flow and must therefore be fitted so that it faces the air stream.

- The sharp measuring edge of the air-flow sensor plate points in the direction of the air filter.
- The slightly rounded edge points in the direction of the air funnel and intake manifold. 6 and 8 cylinder mixture-control units with downdraught air-flow sensor have air-flow sensor plates with a bezel on the otherwise usual rounded edge.

Marking

- Up till now most air-flow sensor plates have been marked on a surface with 5 punch marks or with the word "TOP".
  This marked surface must always be at the top of the air-flow sensor.
  This applies to both updraught and downdraught air-flow sensors.
- For precision reasons, an increasing number of air-flow sensor plates will be ground at the circumference during production as from mid-1983. On account of the sharp-edged surfaces on both sides, there will be no marking of any kind. These air-flow sensor plates can be fitted whichever way is desired.

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